UNIVERSITY OF ALBERTA

Critical Thinking Skills and Critical Thinking Dispositions of Baccalaureate Nursing Students

by

Joanne Profetto-McGrath

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfilment of the requirements for the degree Doctor of Philosophy.

Faculty of Nursing

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled *Critical Thinking Skills and Critical Thinking Dispositions of Baccalaureate Nursing Students* submitted by Joanne Profetto-McGrath in partial fulfilment of the requirements of the degree of Doctor of Philosophy.

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To my wonderful husband Larry and my sons, Ryan and James
for their love, patience, and unfailing support
during these past years.
You have been the wind beneath my wings.

Abstract

Critical thinking is significant in a practice discipline such as nursing. The ability of nurses to think critically affects areas of nursing such as education, practice, research and theory development. Therefore, knowledge and understanding of nursing students' critical thinking skills, their disposition to think critically, and the variables associated with critical thinking are crucial. The purpose of this study, which used a cross-sectional, correlational, descriptive design, was to investigate the critical thinking skills and the disposition toward critical thinking of nursing students enrolled in a four-year baccalaureate nursing program at one of Canada's leading universities. An additional purpose of this study was to determine the relationship between specific variables and the students' critical thinking skills. The conceptual framework used for this study is comprised of the two dimensions associated with critical thinking. These dimensions include cognitive skills and affective dispositions as described by Facione and Facione (1992).

A convenience sample of 228 nursing students across all four years of the baccalaureate program completed three instruments: a Background/demographic Questionnaire specifically designed for this study; the California Critical Thinking Skills Test (CCTST) Form A; and the California Critical Thinking Disposition Inventory (CCTDI). The sample achieved a mean of 17.43 out of a possible score of 34 on the CCTST. Year mean scores ranged from 16.70 to 17.93, which fall between the 60th and 70th percentile based on norms for undergraduate nursing students calculated by Facione (1997). Years one, two and four achieved their best scores on the inference sub-scale. Year three attained its best mean score on the analysis sub-scale. The

CCTST evaluation sub-scale mean scores were lowest for all four groups. Based on analysis of variance (ANOVA) there was no significant difference among the four groups of participants on the overall CT mean scores ($p = .05$).

Out of a maximum score of 420, the mean scores for the CCTDI ranged from 304.24 to 315.36, with an overall sample mean score of 312.30, which reflects a positive score. Most participants (85.50%) scored between 280 and 350 (positive scores). The ANOVA indicates no statistically significant difference ($F = 0.822$, $df = 3$, $p = 0.483$) among the four groups. The maximum score achievable on any of the seven dispositions is 60. A score higher than 50 on any of the sub-scales reflects a strength in that disposition. A score between 40 and 50 reveals a positive inclination. Scores between 31 and 39 show an ambivalent inclination to the specific disposition; whereas, scores of 30 or lower indicate a negative tendency (Facione, 1997). The sample scored lowest on the truth-seeking sub-scale (37.56) and they scored highest on the inquisitiveness sub-scale (48.99). Systematicity was the only sub-scale which differed significantly among the four groups. An important finding was the significant relationship between the students' critical thinking dispositions and critical thinking skills ($\chi^2 = 9.37$, $p = .014$, power $>.80$). Although further research studies are needed to confirm this relationship, these findings appear to support the belief expressed by many authors that both cognitive skills and the affective component need to exist in order for an individual to be an effective critical thinker.

The results of this study are valuable for a number of purposes. Several questions are raised to guide further nursing research studies. Implications and recommendations are offered for nursing education and nurse educators.

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CHAPTER 1

Introduction

Critical Thinking and Nursing Education

In recent years it has become increasingly apparent that if individuals, and indeed professionals such as nurses, are to succeed in a highly competitive and technologically driven society, they will require the necessary skill of critical thinking (Paul, 1993). In 1929 the renowned philosopher and educator Alfred Whitehead (1967) noted, "Your learning is useless to you till you have lost your text, burnt your lecture notes, and forgotten the minutiae you have learnt by heart for the examination" (p. 26). His observation intimates that the true outcomes of education are "the thought processes that result from the study of a discipline, not the information accumulated" (Meyers, 1986, p. 2). Although the writer does not advocate such measures as burning books, nurse educators are wise to ponder such statements for the implications they hold for individuals, courses, and curriculum development.

According to Facione and Facione (1994), the education of successful professionals requires attention to practical experience, content of the discipline and critical thinking. Thus, students need the skills and attitudes that are necessary for facing the twenty-first century (Knowles, 1980; Paul, 1993) because "facts learned in youth have become insufficient and in many instances actually untrue; skills learned in youth have become outmoded by new technologies" (Knowles, 1980, p. 28). In a time when textbooks are frequently obsolete even while in press and when the majority of professions are undergoing rapid cutbacks and reform, it is inevitable that the goals and objectives of education must also change (Meyers, 1986).

Heaslip (1994) pointed out that in the United States and Canada, professional nursing organizations are re-examining the functions and goals of nursing education and the competencies and skills essential to practice as nurses. Nursing professionals recognize that critical thinking is crucial to the educational experiences of all students and essential for new graduates. There is no shortage of supporters who argue for the need to

infuse critical thinking into the educational process of nurses (Burnard, 1989; Callister, 1996). Nonetheless, although there may be agreement that critical thinking in nursing education is relevant we as nurse educators need to ask ourselves the following questions:

> Do we really want students to think? Do we want them to become more critical and more questioning and less likely to accept things at face value? Do we want more critical debate in the classroom and less reliance on the teacher as the authority? (Wasserman, 1987, p. 465).

If the answers to these questions are a definitive yes, then teaching critical thinking skills and promoting/facilitating those attributes that are reflective of the ideal critical thinker should be one of the major goals of nursing curricula.

Educators who believe in the importance and need for critical thinking in nursing education and who recognize that nursing education is not merely a fact-loading process (Facione, Facione, & Sanchez, 1994) have taken the first key step. A number of nursing organizations such as the National League of Nursing (NLN) and the Canadian Association of University Schools of Nursing (CAUSN) have recently included critical thinking as a curriculum requirement or outcome. This decision parallels adoption of the same goal by numerous other academic disciplines (Glen, 1995; Jones & Brown, 1990). A commitment to teaching 'how to think versus what to think' and the belief in the power of critical thinking encourages and stimulates the development and enhancement of nurse educators' own critical thinking skills. This may then allow them to broaden their repertoire of teaching approaches from traditional strategies to those strategies that are more empowering, interactive, and rewarding for students in the short and long term. Strategies that have been suggested in the literature to achieve these goals include, but are not limited to, role plays; role modelling; debates; panel discussions; structured controversies; games; various exercises such as guided design; clinical rounds; forums; exemplars; case studies comprising group discussions and dialogue; and assessment of learning such as concept mapping (Novak & Gowin, 1989); and writing to learn exercises.

Nursing students who are thinking critically are forming ideas, and not simply memorizing, duplicating the ideas of others, or accepting uncritically what they are told.

They become actively engrossed in reasoning about nursing and all its complexities. They begin with what is known or presumed and proceed to infer, interpret and analyze. As students begin to realize that they are in command of their thinking processes they become predisposed to and accept control of their own learning. They proceed from being mainly passive learners to more active learners (Bandman & Bandman, 1995; Heaslip, 1994; Ruggiero, 1990).

Critical Thinking and Nursing Practice

Nursing practice is unique in that nurses work with people as they journey through life, from birth to death. Nurses have the opportunity to come together and collaborate or work with clients (individuals, families, groups, communities) in a variety of situations in settings such as homes, industries, recreational centres, schools, communities, institutions, community centres, hospitals and churches. As a result, nurses are faced daily with difficult issues and decisions for which they do not always have definitive solutions. Therefore, it is imperative that nurses know how to rationally examine what confronts them. They must use a variety of resources and perspectives in making decisions and solving problems in order to continually strive for safe, competent, and skilful nursing practice.

Because of the work that nurses do, critical thinking is indispensable to their practice for a number of reasons (Daly, 1998; Gillmore, 1993; Kataoka-Yahiro & Saylor, 1994; Kemp, 1985; Lewis & Eakes, 1992; Miller & Malcom, 1990; Snyder, 1993; Sullivan, 1987). First, nurses who engage in critical thinking are less likely to make judgemental and fallacious statements and conclusions. Secondly, they are more apt to focus on the circumstances surrounding practice related issues; separate relevant from irrelevant data; make clinical inferences from the data; and remain open-minded to interpret and evaluate the findings and weigh them against other evidence. Thirdly, nurses who engage in critical thinking tend to be open to prudent self correction, with the aim of providing safe practice based on knowledge derived from research and not mere personal preference and opinion (Facione, Sanchez, Facione, & Gainen, 1995; Miller & Malcom, 1990). Finally, nurses who engage in critical thinking can "change the face of practice and

the health care system at large," (Heaslip, 1994, p. 32) such that all persons who come in contact with them will benefit from a more caring practice, infused with critical thought and reasoned action. Nurses who are critical thinkers can, if they are sufficient in numbers, "change the whole health care system in ways that are of great benefit to the people" (Bevis, 1989, p. 353 as cited in Heaslip, 1994).

Overview of the Problem

At the Faculty of Nursing, University of Alberta, critical thinking is listed as a graduate outcome for both the collaborative curriculum implemented September 1991 (1991 program) and the newly implemented context-based curriculum implemented in September 1997. The students who commenced their program between 1993 and 1996 will complete the 1991 program. The problem which stimulated this research study was that prior to implementing the context-based curriculum faculty members did not have a comprehensive overview of the critical thinking abilities of nursing students enrolled in the 1991 program. They also did not have any data regarding the effect that the existing program had on students' critical thinking skills. Furthermore, there is no substantial evidence in the literature indicating whether context-based nursing curricula enhance critical thinking skills. In order to ascertain the latter, it was important to collect data regarding critical thinking skills of nursing students in the 1991 collaborative program. These data may be used for comparison with the critical thinking skills of students enrolled in the program which commenced in September 1997.

Purpose

The purpose of this study was to determine the disposition toward critical thinking and the critical thinking skills of nursing students enrolled in a four year baccalaureate nursing program at the University of Alberta. An additional purpose of this study was to ascertain the relationship between the students' critical thinking dispositions and their level of critical thinking skills. Furthermore, this study was undertaken to determine the relationship between other variables and the students' skills of critical thinking. These variables were the students':

- age and gender

- language of origin
- level of academic achievement prior to entering the nursing program
- years of nursing education completed, participation in the accelerated timetable
- experience with problem-based learning
- previous completion of a college or university level course specifically designed to teach students how to think logically, to improve their reasoning, or to sharpen their critical thinking skills.

Research Questions

The specific research questions that guided this study were as follows:

1. What are the critical thinking skills of baccalaureate nursing students in years 1, 2, 3, and 4 at the University of Alberta (UofA)?

2. Do the critical thinking skills differ among baccalaureate nursing students in years 1, 2, 3, and 4 at the UofA?

3. What are the critical thinking dispositions of baccalaureate nursing students in years 1, 2, 3, and 4 at the UofA?

4. Do the critical thinking dispositions differ among baccalaureate nursing students in years 1, 2, 3, and 4 at the UofA?

5. What variables are associated with critical thinking skills of baccalaureate nursing students at the UofA?

6. What is the relationship between critical thinking dispositions and critical thinking skills of baccalaureate nursing students in years 1, 2, 3, and 4 at the UofA?

Research Design

This study was conducted using a cross-sectional descriptive correlational design. The design is further described in Chapter 3.

Conceptual Framework

The conceptualization of critical thinking that guides this study is based on the consensus statement regarding critical thinking and the ideal critical thinker (American Philosophical Association, 1990) (APA). This conceptualization comprises two important dimensions that are inherent in critical thinking: cognitive skills and affective dispositions.

It is based on the Delphi Study which was completed over a two year period by 46 experts in critical thinking from Canada and the United States. The reports provided and the resultant descriptions of the ideal critical thinker and critical thinking are discipline neutral, allowing for ease of use in nursing.

> According to the APA, critical thinking is characterized as:
> Purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgement is based. (p. 3).

Each of the six critical thinking cognitive skills: interpretation, analysis, evaluation, inference, explanation, and self-regulation that make up the overall concept of critical thinking constitute respective sub-skills (Appendix A). For example, the critical thinking cognitive skill of analysis includes the sub-skills of examining ideas, identifying arguments, and analyzing arguments.

The California Critical Thinking Skills Test (CCTST, Form A and B) developed by Facione and Facione in 1990 is based on the description and skills developed by the APA. The first three CCTST sub-scales conceptualized from the Delphi report are analysis, inference, and evaluation. The two traditional categories are deductive and inductive reasoning. According to Facione and Facione (1992), deductive reasoning is primarily composed of the items extrapolated from the analysis and inference sub-scales; whereas, the items comprising the category of inductive reasoning are drawn from the evaluation and inference sub-scales (pp. 4 & 10). The dispositional component also referred to as habits of mind is reflected in the APA conceptual definition which includes a portrayal of the ideal critical thinker as one who is:

> habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgements, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused on inquiry, and persistent

> in seeking results which are as precise as the subject and the circumstances of inquiry permit (p. 3).

The above description of the ideal critical thinker was foundational to the development of the seven critical thinking dispositions by Facione and Facione (1992). These dispositions are truth-seeking, open-mindedness, analyticity, systematicity, critical thinking self-confidence, inquisitiveness, and maturity. Each of these dispositions are described in Chapter three and summarized in Appendix B. The California Critical Thinking Disposition Inventory (CCTDI) developed by Facione and Facione (1992) captures these seven individual dispositions to reflect an overall level of disposition toward critical thinking.

Combining the CCTST and the CCTDI allows for the composite assessment of an individual's overall level of critical thinking, including his/her cognitive skills and attributes. These skills and attributes are critical to professional nursing practice of nursing students and nurses.

CHAPTER 2

Literature Review

Indisputably, critical thinking is a significant component of both baccalaureate and graduate nursing education. In an increasingly competitive and technologically- driven society, critical thinking is indispensable to any professional (Paul, 1993). No longer is it sufficient to merely possess knowledge; rather one must think about that knowledge and use it in an effective and appropriate manner.

Although Dewey and Watson and Glaser discussed critical thinking in the general literature as early as 1900, it was not until the early 1980s that advocates and educators such as Paul (1984), Brookfield (1987), Sternberg (1985) and others highlighted its value and importance in professional disciplines such as nursing. Some might argue that critical thinking has always been acknowledged and present in the nursing literature in the form of decision making, problem solving, and the nursing process. However, Profetto-McGrath and Myrick (1996), after an extensive concept analysis, contended that "critical thinking is indeed distinct from the concepts of problem solving, reflective thinking, creative thinking and decision making"(p. 10), even though it is central to these processes. This assertion has also been supported by Ford and Profetto-McGrath (1994), Jones and Brown (1991), and Tanner (1997).

Some authors assert that the prominence of critical thinking in nursing has been raised because of increased technology, knowledge expansion, and increased complexity of health care (Brigham, 1993; Callahan, 1992; Gillmore, 1993; Heaslip, 1994; Kataoka-Yahiro and Saylor, 1994; Miller & Malcom, 1990; & Snyder, 1993). According to Kramer (1993) the benefit of critical thinking to the discipline of nursing is indisputable. Jones and Brown (1990) added emphasis to this assertion in their statement that "critical thinking can give nursing a lifeline into the future development of the discipline" (p. 533).

The amount of theoretical and empirical literature on critical thinking and critical thinking dispositions is abundant yet diverse. In an effort to present selected literature as a foundation for this research study, the literature review has been organized and presented in this section using the following outline:

- major definitions of critical thinking and critical thinking dispositions;
- critical thinking models;
- the measurement of critical thinking and dispositions including an historical perspective, instruments and related issues;
- the current context in nursing with a focus on the prevalence of critical thinking in baccalaureate nursing programs;
- nurse educators' critical thinking skills;
- factors influencing critical thinking and critical thinking dispositions;
- critical thinking as a correlate of success in nursing, relationship of critical thinking to other processes;
- summary.

Defining Critical Thinking and Critical Thinking Dispositions

Critical Thinking

One recurrent question raised in the literature about critical thinking is: "What is critical thinking?" As many definitions of critical thinking have been proposed as there are experts who define it (Daly, 1998; Profetto-McGrath & Myrick, 1996; Rane-Szostak & Fisher Robertson, 1996). Definitions vary according to the authors' world view and perspectives. As Beyer (1987) contended "the term critical thinking is one of the most abused terms in our thinking vocabulary. Generally it means whatever its users stipulate it to mean" (as cited in Maynard, 1996, p. 13).

One of the more accepted and utilized definitions of critical thinking is the one developed by Watson and Glaser (1964). Broadly, they view critical thinking as a synthesis of attitudes, knowledge, and skills:

> 1) Attitudes of inquiry that involve an ability to recognize the existence of problems and an acceptance of the general need for evidence in support of what is asserted to be true; 2) knowledge of the nature of valid inferences, abstractions, and generalizations in which the weight of accuracy of different kinds of evidence are logically determined; 3) skills in employing and applying the above attitudes and knowledge (p. 10).

McPeck (1981) considered critical thinking as "the propensity and skill to engage in an activity with reflective scepticism" (p. 8). Meyers (1986) defined critical thinking as the ability to raise appropriate questions and analyze solutions without necessarily offering alternatives. Ennis' (1987) definition of critical thinking encompassed two specific attributes: he believes that critical thinking involves reflection and must be reasonable. In his estimation these two criteria are crucial if critical thinking is to be useful to the individual in deciding what to believe or do. For Brookfield (1987), critical thinking was more of a process than an outcome. Indeed, he views critical thinking not as an "abstract academic pastime" (p. 14), but as an activity which is productive, positive and lived. Furthermore, according to Brookfield, assumptions and context are two major components central to the understanding of critical thinking. He believes that critical thinkers must identify and challenge assumptions that then shape their thinking and actions, while considering the culture and context. The extensive work by Facione and Facione during this past decade has been based on the American Philosophical Association's (APA) (1990) definition of critical thinking. In this definition, critical thinking is deemed to be a judgement that is purposeful and self-regulatory in nature, and is based on evidence arrived at in a methodical way within context. Miller and Malcom (1990), who believed that critical thinking development should be part of every nurse's basic education, claim that critical thinking is an aggregate of an inquiring attitude. That is, grounded in a solid knowledge base and fostered by acquisition skills. Indeed, they believed that critical thinking as an approach rather than an outcome is a must to explore professional and practice issues and to find ways to deal with these issues. According to Ruggiero (1990), decision making, problem solving, and purposeful dialogue of controversial topics depend on critical thinking because in his estimation critical thinking is a process to evaluate ideas. Undoubtedly, critical thinking is needed to accurately appraise statements and evaluate the soundness of a conclusion that has been reached as a result of the reasoning process. Paul (1992) described critical thinking as the "art of thinking about your thinking while you are thinking in order to make your thinking better, more clear, more accurate and more defensible." (p. 11). He also defined critical thinking

as "a systematic way to form and shape one's thinking. It functions purposefully and exactingly." (p. 12) According to Paul, critical thinking is thought that is "disciplined, comprehensive, based on intellectual standards, and, as a result, well-reasoned" (1993, p. 20). He further observed that the fundamental premise of critical thinking is excellence in thought and that we should strive for strong sense or fair-minded critical thinking versus weak sense or sophistic critical thinking. For Alfaro-LeFevre (1995), critical thinking encompasses purposeful and goal directed thinking, needs judgements that are based on evidence rather than speculations, builds on scientific principles and methods, and demands strategies that maximize human potential and offset problems effected by human nature (p. 9). Finally, based on an extensive concept analysis of critical thinking, Profetto-McGrath and Myrick (1996) proposed the following description of critical thinking. Critical thinking is an

> active, ongoing cognitive process of logical reasoning in which the individual methodically explores and analyzes issues, interprets complex ideas, considers all aspects of a situation and/or argument and where appropriate follows with prudent judgement (p. 10).

This last definition incorporates process, skills and attitudes as well as astute decisions as deemed necessary.

Based on the review of the literature about the concept of critical thinking, it is obvious that there is no one 'correct' way to define or describe critical thinking because of its complexity. The preceding definitions provide a synopsis that depicts the diverse perspectives of those with expertise in the area of critical thinking. Although overlaps and similarities exist among authors' definitions of critical thinking, some obvious differences remain. Some consider critical thinking as a process while others view it as a set of specific skills aimed at arriving at some end point. Because of the diverse definitions of critical thinking, it is doubtful that a consensus will ever be achieved. This researcher believes that the ongoing process to define critical thinking will be become "increasingly complex the more one learns" (Jacobs, Ott, Sullivan, Ulrich & Short, 1997, p. 21).

Critical Thinking Dispositions

Ennis (1985), Paul (1992), Facione, Facione, and Sanchez (1994), and Norris (1995) believe that a comprehensive education of good critical thinkers includes not only the development of the skills of critical thinking but also the fostering of dispositions toward critical thinking. According to Facione (1997), the dispositional dimension of thinking can be traced as far back as the ancient Greek civilizations and to Dewey's writings first published in 1910 (as cited in Facione, p. 92). The Greeks valued the virtues or habits of mind as highly as those associated with moral, social and physical qualities. Facione states that the "disposition toward critical thinking is best described as the consistent internal motivation to engage problems and make decisions by using thinking" (p. 13). Other authors including Alfaro-LeFevre (1995), Hunter and Lops (1994), Miller and Babcock (1996), Paul (1993, 1997) and Ruggiero (1990) also discussed the disposition toward critical thinking even though they use somewhat dissimilar terminology to characterize it.

According to Ennis (1985) the critical thinking abilities and dispositions are integrated into an individual's beliefs or actions. Open-mindedness, seeking as much accurate information as the subject permits, dealing with the aspects of a complex whole in an systematic way are a few of the dispositions considered important by Ennis.

Paul, for example, described the ideal critical thinker as one who is "intellectually humble and hence is continually seeking to recognize the limitations of her knowledge" (1997, p. iv). He also refers to dispositions as traits of the reasoning mind which he considers to be interdependent. These include: intellectual humility, courage, empathy, integrity, perseverance, faith in reason and fairmindedness (pp. 15-16).

Similarly to Paul (1997), several characteristics that differentiate critical thinkers from uncritical thinkers were identified by Ruggiero (1990) who believes that individuals must be mentally disciplined. He described critical thinkers as honest individuals who recognize their own limitations and view controversies and problems as challenges rather than threats. Critical thinkers are curious and patient when faced with complex and confusing issues. Furthermore, they are open-minded, tolerant of divergent views and able

to suspend judgement pending additional evidence. Finally, Ruggiero characterized critical thinkers as fairminded individuals who pursue a balanced view rather than the one which supports solely their own view.

Miller and Babcock (1996) also believed that dispositional traits are important to critical thinking. As part of an extensive list of dispositional traits they include openness, fair-mindedness, hunger for truth, willingness to listen, courage, intellectual honesty, confidence, and integrity. In the absence of these traits, Miller and Babcock assert that critical thinking is diminished, inhibited, or disabled.

Alfaro-Lefevre (1995) dedicated a substantial part of her book to the characteristics and habits of mind of critical thinkers because she believed that: "The future belongs to those of us who learn to make the most of our brain power -- those who think critically" (p. 14). This statement not only implies that critical thinking can be learned but also that individuals must have some traits/dispositions to pursue such a goal. For Alfaro-LeFevre the "perfect role model critical thinker" (p. 9) is portrayed by numerous characteristics that are similar to those identified by Facione and Facione (1992), Miller and Babcock (1996), and Paul (1992). These are open-mindedness, fair-mindedness, curiosity, and insight, systematicity, knowledge of their biases and limitations, and humility.

Dispositions, traits, attributes or habits of minds are crucial to the process of critical thinking and there seems to be a fairly strong consensus on what these are. The work of many authors also reflects a strong belief that, despite the presence of cognitive skills needed to be an effective critical thinker, without the affective component critical thinking does not happen or if it does may be less than optimal or substandard.

Critical Thinking Conceptual Models

According to Fawcett (1995), conceptual models are synonymous with such terms as conceptual frameworks, conceptual systems, paradigm, and disciplinary matrix. They are composed of abstract and general concepts and premises that configure and link ideas into a meaningful layout or pattern. Conceptual models contribute unique perspectives about specific phenomena. Consequently, they may serve several purposes. They may be

useful as frameworks for activities such as teaching strategies development or curricula development. They may be valuable in the search for answers to relevant questions. Conceptual models may provide a foundation for research studies or development of new instruments to assess critical thinking. In addition they may simply be helpful in assisting others to understand the phenomena. The discussion that follows is not intended to be a comprehensive review of all critical thinking models but a presentation of some of the models available.

Several authors have proposed models in an attempt to conceptualize and visually communicate what constitutes critical thinking, (Conger & Mezza, 1996; Ennis, 1985; Ford & Profetto-McGrath, 1994; Hunter & Lops, 1994; Kataoka-Yahiro & Saylor, 1994; Miller & Babcock, 1996; Ulsenheimer, Bailey, McCullough, Thornton, & Warden, 1997; Videbeck, 1997). Each was based on the work of various theorists. These models reflect the authors' beliefs about critical thinking and critical thinking dispositions.

Ennis, proposed a critical thinking model entitled *The Process of Deciding What to Believe or Do.* The model closely reflects Ennis' definition of critical thinking. It comprises several key elements including: a *basis of inferences* for making *decisions about belief or action*, and problem-solving which requires focus on *clarity* and *critical thinking dispositions* within a context *interaction with others* (1985, p. 48).

The model of critical thinking within the context of curriculum as praxis developed by Ford and Profetto-McGrath (1994) is based on the work of such theorists as Habermas, Freire and Grundy. Praxis, as used in their model, denotes action and reflection (Grundy, 1987). The authors describe three different curricular orientations, each informed by different interests. Curriculum as product is informed by a technical interest; curriculum as practice is informed by a practical interest; and curriculum as praxis is informed by emancipatory interest. Furthermore, Ford and Profetto-McGrath asserted that how one views critical thinking differs based on the type of interest which informs a particular curriculum. Their simple model, comprising three key elements: knowledge and action mediated by critical reflection, was proposed as one congruent with curriculum as praxis (p. 342). Tanner (1997) believes that these authors' "conception of critical thinking

as challenging taken-for-granted assumptions and practices ...fundamentally presupposes a moral basis of nursing in a nurse patient relationship, in the patient's expectations that he or she will receive compassionate and competent care and ...it is the kind of critical thinking that asks the key question: who benefits and whose ends are being met by a particular nursing action?" (p. 4). Various aspects stipulated in this model have been incorporated in several other models described below.

A model developed by Conger and Mezza (1996) is intended to help instructors externalize the critical thinking behaviors of students in the clinical area. It does so by incorporating the cognitive skills and seven dispositions discussed by Facione and Facione (1992), aspects of the model by Ford and Profetto-McGrath (1994), and Benner's (1984) description of the expert nurse, who is able to engage in critical reflection and views situations holistically. Because many instructors are familiar with the generic steps of the nursing process, these steps were included in the first part of the model. They depict the students' actions within the linear approach to decision making and are logically connected to the other components of the model. In the centre of the model the authors incorporate Facione and Facione's seven dispositions as part of the reflective process discussed by Benner, and Ford and Profetto-McGrath. The connections between dispositions and the students' actions are illustrated with arrows. For example, when the student is engaged in data collection and organization, he/she needs to utilize critical thinking skills such as analysis, interpretation and categorization. Through reflection, use of knowledge, and guidance from the instructors students are assisted to move forward in the process. The third part of the model, depicted at the right side of the diagram features instructors' interventions. For example, when the student is in the stage of formulating an hypothesis (nursing diagnosis), he/she needs to consider the assumptions inherent in the hypothesis. The instructor facilitates this process through dialogue with the student and by challenging him or her to justify or clarify the assumptions.

Hunter and Lops' (1994) belief that critical thinking and nurse-midwifery are intrinsically intertwined led to the development of their critical thinking process model. Hunter and Lops' model was an adaptation of Paul's work. The first domain, element of

thought, is presented as the nucleus of the model. The remaining four domains: traits of the mind, modes of reasoning, reasoning abilities, and intellectual standards, contribute to the core domain to arrive at conclusions. Traits of the mind encompass the qualities of empathy, curiosity, intuitiveness, and emotional feelings. These traits promote the care and concern in decision-making. Modes of reasoning consist of the ability to pursue reliable sources of data through activities such as reading, writing, and listening. Reasoning abilities include the skills of analysis and questioning; these abilities serve to sustain reasonable decision making. Finally, intellectual standards, which allow the critical thinker to make sound decisions, refer to constancy, fairness, and integrity.

Kataoko-Yahiro and Saylor (1994) created their model entitled *Critical Thinking Model for Nursing Judgement* as a way to incorporate critical thinking in a newly developed curriculum for undergraduate nursing students. The title reflects both the process of critical thinking, and the outcome, nursing judgement. In the context of this model nursing judgement is deemed to be discipline specific clinical judgement. The authors define nursing judgement as "decisions formed in direct, semi-direct, and indirect nursing care roles" (p. 352). Kataoko-Yahiro and Saylor chose to include nursing judgement instead of clinical judgement because the former is applicable to nurses in a variety of roles and settings; whereas clinical judgement focuses specifically on client situations. The model is based on the work of Glaser (1941), Miller and Malcolm (1990), Paul (1993), and Perry (1970). As a result, it includes five components of critical thinking, namely specific knowledge base in nursing; experience in nursing; critical thinking competencies; attitudes for critical thinking; and intellectual and professional standards (p. 353). These five components contribute to the three levels of critical thinking in nursing (adapted from Perry's (1970) positions of basic, complex, and commitment). Although not specifically illustrated as a definite component of their model, Kataoko-Yahiro and Saylor assert that characteristics of a learning or work environment and the individuals therein are very influential to one's critical thinking ability (p. 355).

McDonald (1996) also developed a critical thinking model as a component of a new curriculum. It is represented by the pattern of a tree. The figure of the tree was

chosen because it represented a living entity that draws 'nourishment' from its roots of caring and knowledge and changes in response to the environment. The element of critical thinking was included as part of the trunk and was further explicated in a simpler teaching/learning model within the article (p. 35). Although McDonald states that the outcome of critical thinking is not predictable nor consistent and that it cannot be achieved through a single formula, she fails to define critical thinking further. She conceptualized the teaching/learning model using three overlapping circles. These circles represent her three key elements: the teacher as the critical agent; the learner as self-directed individual; and the environment as dialectical supported by an atmosphere of comfort, openness, mental stimulation, safety, and humanness (p. 34).

Videbeck's (1997) model was designed in response to the NLN accreditation criteria. It provides direction for nurse educators to develop and evaluate critical thinking abilities of student nurses. Her model uses the process of curriculum development by Torres and Stanton (1982), the principles of program evaluation outlined by Litwok, Linc and Bower in 1985, and the conception of critical thinking by Brookfield (1987) and Paul (1993). In addition to being discussed within the context of its implementation phases, the major components and their relationship within the model are illustrated. Videbeck stated that critical thinking should be regarded as a process and not merely as an outcome. She also offered several excellent assumptions that need to be examined and questions that need to be discussed by educators when implementing such a model. However, she points out that with any new process "more and better questions are generated by those involved in its use" (p. 28).

The incentive behind the development of Trotter's (1996) critical thinking model was her desire to assist practising nurses in the development of comprehensive definitions for catheter-related sepsis (CSR) to be used for clinical practice and research activities. Trotter utilized three models developed by Ford and Profetto-McGrath (1994), Hunter and Lops (1994), and Kataoka-Yahiro and Saylor (1994) because she believed these models were similar in many ways. Trotter organized these similarities using the three elements identified by Ford and Profetto-McGrath: knowledge, critical reflection, and

action. The resulting model was implemented in the NICU at a medical centre in St. Louis, Missouri with extensive input from a variety of individuals.

Ulseheimer, Bailey, McCullough, Thornton, and Warden (1997) are a group of nurse educators and managers whose conviction that "nurturing critical thinking in the staff will have a positive impact on care delivery outcomes" (p. 154) led them to develop a critical thinking model that would serve to foster, improve and further develop the staff's critical thinking skills in the clinical setting. Their layered model, which aims to promote what they refer to as an infinite process, was heavily influenced by the work of Brookfield (1987). They drew from his strong position on assumptions and an equally strong emphasis on the skill of questioning which may be judged as difficult and/or awkward by some individuals. This model was piloted on two patient care units in an effort to ascertain the level of utilization among staff. The users of the model identified both positive as well as negative results. In addition, a number of suggested measurable outcomes were offered following utilization. These consisted of improved patient care evidenced by such incidents as a decline in medication errors and decrease in length of stay; enhanced use of critical thinking; team work characteristics including an increase in the sharing of ideas; and enhanced staff satisfaction including aspects associated with a rise in staff morale (p. 156).

Miller and Babcock (1996) entitled their model the *Critical Thinking Interaction Model*. It is expected to have a broad application to nursing practice because it can be extensively utilized by competent individuals in a variety of settings. The model is based on several components, each, with a specific interaction or role. These interactions take place between nurse and other. In this model Miller and Babcock refer to the term 'other' as client and family, administrators, or colleagues. The quality and nature of these interactions are influenced by focus, language, evidence, and reasoning. Context is another important element of this model. The authors describe context as the entire situation and visually depict it as several concentric circles representing the immediate situation, family/significant others, the health care system, society at large, and the universe (pp. 20-21).

Measuring Critical Thinking and Critical Thinking Dispositions

Historical Perspective

Measurement of critical thinking began four decades ago with the Watson-Glaser Critical Thinking Appraisal (WGCTA). This tool was first developed in the 1940s, and revised in 1964 and then again in 1980. Miller (1992) reports that the first major research aimed at measuring critical thinking at the higher educational level was carried out in 1954 by a group known as the Cooperative Study of Evaluation in General Education. This group also developed an instrument to measure critical thinking and sought to establish its validity by correlating the instrument with the WGCTA. A model was established as part of this research to pretest and post-test students at the beginning and end of an educational program. In 1956, using the WGCTA, Beckman studied the extent to which courses in argumentation and discussion improved critical thinking.

According to Miller (1992) the earliest study in nursing to assess the influence of curricula on students was carried out by Richards in 1977. The study utilized the WGCTA as a pre and post test with students from two different curricula: the old block curriculum and a newer integrated curriculum (Richards, 1977). Results indicated that students who completed the integrated curriculum had less critical thinking ability than the students who completed the block curriculum. Richards attributed the difference in the critical thinking ability between the two groups to the consistent teaching approach used in the integrated curriculum as compared to the block curriculum. According to Hickman (1993), the second study in nursing was conducted by Frederickson and Mayer (1977) who also used the WGTCA. This study explored the impact of higher educational levels on nursing students' critical thinking abilities and the relationship between education and problem solving. Although several limitations are inherent in this study such as sample size and convenience sampling, the researchers concluded that, within the confines of their study, higher educational levels and critical thinking were related. However, higher education was not related to the performance associated with problem solving.

Since the completion of these early studies additional studies comprising undergraduate nursing students, graduate nursing students, and practising nurses as

participants have also been undertaken. Several synoptical analyses (Beck, Bennett, McLeod, & Molyneaux, 1992; Hickman, 1993; Kintgen-Andrews, 1991; Myrick & Profetto-McGrath, 1998; Norris, 1985) were done primarily to examine and synthesize the research related to critical thinking in nursing.

Instruments and Measurement Issues

Instruments. According to Rane-Szostak & Fisher Robertson (1996), "measuring critical thinking is a challenging process" (p. 10) . The choice of the most appropriate means to measure critical thinking is a difficult one that poses serious demands for educators and researchers alike. According to Facione (1990, pp. 36-49), several commercially available critical thinking assessment tools exist. They include but are not limited to the: *Basic Skills Assessment (1977-1981), California Critical Thinking Skills Test (CCTST) (1992), Collegiate Assessment of Academic Proficiency (1988), Cornell Test of Critical Thinking Ability (1985), Deductive Reasoning Test (1972-73) Education Testing Service Academic Profile Test, Ennis-Weir Critical Thinking Essay Test (1985), New Jersey Test of Reasoning Skills, (1983), Test in Appraising Observations (1983), Test of Inquiry Skills (1979), Test of Cognitive Skills (1981), and the Watson-Glaser Critical Thinking Appraisal (WGCTA) (1980)* .

These commercially developed instruments are appealing: they have often been developed by experts in the area of critical thinking with input from those with expertise in the area of test construction; they have usually undergone validity and reliability testing over time; and they save extensive and valuable time required to develop such assessment tools (Rane-Szostak & Fisher Robertson, 1996). Five of the most widely utilized tools available to measure critical thinking are discussed in the following section. They are the Watson-Glaser Critical Thinking Appraisal (WGCTA), The Cornell Test of Critical Thinking Ability, The Ennis-Weir Critical Thinking Essay Test, The California Critical Thinking Skills Test (CCTST), and The California Critical Thinking Disposition Inventory (CCTDI).

Watson-Glaser Critical Thinking Appraisal (WGCTA). To date, in nursing, the most widely utilized instrument for measuring critical thinking is the Watson-Glaser

Critical Thinking Appraisal (WGCTA) last revised in 1980 (Beck, Bennett, McLeod, & Molyneaux, 1992). Grimard Wilson and Wagner (1981) report that the WGCTA has been recognised as a test that "pioneered the measurement of critical thinking" (p. 1319). This instrument measures critical thinking as a general ability. It focuses on the individual's ability to recognize inferences and to evaluate arguments and conclusions (Watson & Glaser, 1980). The 80-item standardized instrument is structured in two formats (A and B), each comprising five subsets (16 questions per subset). The addition of the five subsets produces one total score. The instrument is designed to estimate how well the student is able to reason analytically and logically in five subsets including inference, identification of assumptions, deductions, interpretation, and evaluations of arguments (Brooks & Shepherd, 1990; Saucier, 1995; Watson & Glaser, 1980). The items encompass problems, statements, arguments, and interpretations of data which reflect daily work situations found in the classroom and the media (Hartley & Aukamp, 1994; Saucier, 1995). The test is set at a ninth-grade reading level.

This instrument has been assessed for various types of reliability and validity. Specifically, the Cronbach alpha was used to measure the reliability of each of the subsets with values ranging between .844 and .978 (McCloskey, 1983; Schwirian, 1981). Using the split-half method, reliability to verify internal consistency has generated coefficients ranging from 0.69 to 0.85 with scores stable across time and between the alternate forms (Brooks & Shepherd, 1990; Gross, Takazawa, & Rose, 1987; Maynard, 1996; Rane-Szostak & Fisher Robertson, 1996; Saarman, Freitas, Rapps, & Riegel, 1992; Saucier, 1995; Sullivan, 1987). Alternate forms A and B have an acceptable correlation ($r = .75$) (Gross, et al, 1987; Saucier, 1995).

Validity was initially determined through construct and content validity; however, numerous authors who have used the tool have reported that specific numerical coefficients have not been available to them (Brooks & Shepherd, 1992). The validity of the tool has been determined in teaching settings designed to improve critical thinking and also by comparing it with other mental ability tests (Beck, Bennet, McLeod, & Molyneaux, 1992). Although criterion-related validity has been established with several

variables such as SAT Math, decision making, and GPA (Brooks & Shepherd, 1990; Miller, 1992; Sullivan, 1987; Tiessen, 1987), it did not correlate with other variables such as nursing competence and nursing education generally (Behrens, 1996; Maynard, 1996; Sullivan, 1987). A major criticism associated with the WGCTA has been the ambiguous research results generated with its use. The sensitivity of this instrument is also questionable because it does not detect changes in critical thinking over short periods of time (McMillan, 1987). Because the WGCTA was originally designed to measure critical thinking ability in everyday life situations, it may not be an appropriate tool for measuring changes within the context of teaching situations in nursing and nursing practice. Finally, other potential limitations include its somewhat narrow scope/content and the fact that it is highly dependent upon the critical thinking definition set forth by Watson and Glaser (1980), and thus it is unsuitable when other critical thinking definitions are used (Rane-Szostak & Fisher Robertson, 1996).

The Cornell Test of Critical Thinking Ability. In 1985, an instrument known as the Cornell Test of Critical Thinking Ability was developed by Ennis, Millman and Tomko, based on Ennis' conceptualization of critical thinking. The instrument consists of 52 multiple choice items to be completed over a 50 minute period. The story format utilized in this instrument is predisposed to maintain the examinee's interest. Correlations from split-half internal consistency reliability testing for Level Z (college level) range from a low of 0.55 to a high of 0.76. Although these results are regarded with skepticism in measuring abilities in general, they are considered by some evaluators to be adequate in measuring critical thinking (Rane-Szostak & Fisher Robertson, 1996). Despite this assurance one must be cognizant of the reasons for this occurrence. The variations in the internal consistency may be in part due to the use of the split-half technique, one of the oldest means for assessing this type of reliability. Although the split-half method eliminates difficulties associated with the test-retest technique, and is professed to be easy to use, problems arise because the method used to divide the items into two groups (odd-even split, first half-second half split) may in fact create enough of a difference to produce significantly different correlations (Polit & Hungler, 1987). While this instrument is

designed to measure critical thinking, evaluate reasoning, and assess the ability to recognize assumptions, definitions, fallacies and predictions, it has not received widespread usage in nursing education. In a nursing literature search, only two dissertations using the Cornell test could be found in the last six years. One study assessed the effect of teaching critical thinking in an introductory nursing course (Isaacs, 1990), while the other investigated the critical thinking ability of faculty and students in a baccalaureate nursing program (Jones, 1990).

The Ennis-Weir Critical Thinking Essay Test. The Ennis-Weir Critical Thinking Essay Test (Ennis & Weir, 1985) was one of the first tests developed to measure critical thinking. It is scored by individual examiners who should have had at least one college level course in critical thinking, logic, or the equivalent. Interrater reliability is a major concern because scores are assigned by the individual examiners. According to Rane-Szostak and Fisher Robertson (1996), reports on interrater reliability provided by the test developers for two groups of students were at 0.86 and 0.82. Further reliability and validity data are limited because the test is seldom used. In addition, a number of authors assert that this instrument may serve better as a teaching tool rather than as a measure of critical thinking ability (Rane-Szostak & Fisher Robertson, 1996; Tompkins, 1989). This recommendation has yet to be challenged.

The California Critical Thinking Skills Test (CCTST) and The California Critical Thinking Disposition Inventory (CCTDI). The newest instruments available to measure critical thinking and critical thinking dispositions are the California Critical Thinking Skills Test (CCTST) and The California Critical Thinking Disposition Inventory (CCTDI). The six cognitive skills identified by the Delphi panel as central to the concept of critical thinking are: interpretation, analysis, evaluation, inference, explanation and self-regulation. These six skills are reflected in the items included in the CCTST. The CCTDI represents the first tool intended to measure critical thinking dispositions (Facione, Facione, & Sanchez, 1994). Both the CCTST and the CCTDI were developed by Facione and Facione in 1992. They are based on the APA (1990) Delphi Report's consensus definition of critical thinking and the ideal critical thinker (discussed earlier in this study). These two

instruments are further discussed in the section of Chapter 3 entitled "Measurement Tools".

Measurement issues. Measurement plays a central role in research (Polit & Hungler, 1987; Talbot, 1995). Generally, measurement is defined as the process of assigning numbers to objects, where the numbers and/or words are used to qualify or quantify a concept or phenomenon of interest (Talbot, 1995; Waltz, Strickland, & Lenz, 1984).

Concepts, according to Chinn and Kramer (1995), are complex mental formulations of experiences that are both empiric and abstract. Concepts may be considered empirical because they are formed from encounters with perceivable reality, and abstract because they are not reality, but cognitive representations of that perceptible reality. Furthermore, the authors asserted that as concepts become more abstract, their reality base and related empiric manifestations become less concrete and more difficult to measure, even if they are based on thoughtfully formulated definitions of the concept.

Critical thinking has been described as a vital and complex concept (Brookfield, 1987; Callister, 1996; Case, 1994; Dobrzykowski, 1994; Duldt, 1994; Glen, 1995; Kintgen-Andrews, 1991; Klassens, 1988; Pless & Clayton, 1993; Rane-Szostak & Fisher Robertson, 1996; Schank, 1989; Woods, 1993). Because of the abstract nature of the concept of critical thinking, measurement has been and remains a constant challenge (Rane-Szostak & Fisher Robertson, 1996). Although major progress and efforts have been made in the measurement of critical thinking, a major source of difficulty continues to be the format and composition of the measurement tools. Nonetheless, assessment is an important phase in the development of concepts that may lead to theory development. Empirical validation of concepts such as critical thinking is crucial to the research process and the development of a program of research (Facione, Facione, & Sanchez, 1994; Walker & Avant, 1995). Moreover, researchers interested in measuring abstract concepts such as critical thinking are wise to keep in mind that gathering the evidence that a concept does indeed represent a phenomenon is not "black and white or one-time matter" (Walker & Avant, 1995, p. 186).

Although an extensive discussion of measurement issues in critical thinking is not the focus of this literature review, it is a subject worthy of some attention. Measurement issues have been raised or alluded to in several publications in the form of questions such as: Is there one instrument that best measures critical thinking skills and dispositions? Can the cognitive skills and affective skills comprising critical thinking be measured? If so, what techniques/strategies are most effective to measure or assess critical thinking?

Although many authors have used or critiqued specific instruments that measure individuals' critical thinking skills, no single instrument has been proclaimed as the best measurement of critical thinking abilities. Instruments used to measure critical thinking skills have inherent advantages and disadvantages. Therefore, prior to instrument selection, Rane-Szostack and Fisher Robertson (1996) recommend several factors or criteria that should be considered by the individual(s) wishing to use an instrument. These are:

- The critical thinking definition underpinning the instrument
- Norm versus criterion-referenced measures
- Sensitivity of test scores to expected growth
- Reliability and validity
- Suitability to the program
- Useability/feasibility related to resources (p. 10).

The purpose for conducting a critical thinking assessment is an additional factor suggested by Ennis (1993). Some of the major purposes include: diagnosing the students' level of critical thinking; giving student feedback about their critical thinking competence; motivating students to enhance their critical thinking skills; informing educators about the successfulness of their efforts to teach/facilitate critical thinking; and screening the suitability of students for a particular educational program (Ennis, 1993). The purpose must be clearly understood by educator(s) carrying out the assessment because the purpose may provide guidance about the most appropriate and effective technique or measure for critical thinking assessment.

Despite the fact that commercially available multiple choice tests are efficient and cost-effective to use with large groups of individuals, Norris (1989) believed that "multiple-choice tests cannot test all of critical thinking" (p. 26). Thus, some authors assert that the assessment of critical thinking cannot be fully realized without the use of multiple measures (Ennis, 1993; Facione, 1995; Facione & Facione, 1996; Norris, 1992; Rane-Szostack and Fisher Robertson, 1996). Indeed, "a wide variety of materials can potentially contain evidence of students' critical thinking ability and habits of mind" (Facione & Facione, 1996, p. 47). These multiple measures may include: multiple choice tests with written and/or verbal justification provided by the students; short or long essays type tests; written papers; case study presentations; videos or computer simulations; participatory or non-participatory observation of students' performance in clinical practice; and students' performance assessment over time through the use of portfolios.

Cognitive skills and affective skills comprising critical thinking can be measured; however, because of its complexity educators should give thoughtful consideration to the multitude of factors discussed above. Doing so will serve the goal of critical thinking evaluation.

The Current Context in Nursing

The Empirical Work in Nursing (1977-1997): An Overview

During the last 20 years a number of nursing research studies regarding critical thinking have been undertaken for a variety of purposes. Researchers sought to answer a variety of questions and/or test hypotheses about critical thinking and related aspects. This section of the study, although not exhaustive in nature, reviews and summarizes many of the research studies related to critical thinking in nursing. They are grouped according to related categories.

The Prevalence of Critical Thinking in Baccalaureate Nursing Programs

Since the National League of Nursing (NLN) included an outcome criterion for critical thinking in its 1989 accreditation criteria at least four nation-wide studies using a survey approach (Jones & Brown, 1991; O'Sullivan, Blevins-Stephens, Smith & Vaughan-Wrobel, 1997; Ulrich & Glendon, 1995; Valiga & Bruderle, 1994; Videbeck, 1997) have

been conducted and published on the prevalence of critical thinking in baccalaureate nursing programs accredited by the NLN in the United States. Nursing programs were required to use the revised criteria for accreditation visits, which began in the Fall of 1993 (Videbeck, 1997, p. 5). In Canada, the Canadian Association of University Schools of Nursing (CAUSN) also has an accreditation criterion which stipulates that nursing students should be actively involved in the process of learning critical thinking and must upon graduation display proficiency related to this concept. Unfortunately, no nation-wide research studies have been conducted to ascertain the prevalence of critical thinking instruction in Canada's baccalaureate nursing programs.

What were the findings of the four nation-wide studies? Jones and Brown (1991) were interested in characterizing critical thinking as it was integrated in nursing education programs. Their data collection instruments were based on an extensive literature review. The development of the instruments were also guided by objectives of interest associated with definitions of critical thinking, related components and characteristics, preparation of faculty to teach critical thinking, and strategies utilized to teach critical thinking. They mailed 470 surveys to deans and directors of nursing programs accredited by NLN. Two hundred and twenty five surveys (51%) were returned completed. Based on a comparative analysis, the authors concluded that those programs whose leaders did not respond to the survey were similar in characteristics to those whose leaders did respond. The final sample consisted of 220 (97.8%) basic baccalaureate nursing programs, 177 (78.7%) RN-BSN baccalaureate nursing programs, 93 (41.3%) master in nursing programs, 19 (8.4%) associate degree nursing (A.D.N) programs, and 17 (7.6%) doctoral nursing programs. It should be noted that the total percentage exceeds 100% because some programs offered more than one type of nursing program (p. 531). Of the 220 respondents, 97% indicated that critical thinking was indeed integrated into their programs; however the level of integration was qualified to indicate that 58.2% of the respondents integrated it to a great degree, 28.9% integrated critical thinking to a moderate degree and 12.9% reported very little or minimal use. When asked to choose which concepts described critical thinking, the greatest percentage of respondents selected

risk taking, tolerance for ambiguity, culturally-based, reflective skepticism, and search for objective truth. The processes most often associated with critical thinking included distinction between facts and values, decision-making, logical reasoning, and use of a rational-linear model. In response to the question soliciting information about the preparation activities of faculty who teach critical thinking, five approaches were identified including self instruction (66%), formal academic programmes (62%), conferences (24.4%), training sessions (8.4%), and seminars (2.6%). Lastly, Jones and Brown (1991, p. 532) described three major categories of strategies employed to integrate critical thinking into learning activities: discussion groups (85%), case studies (82%), and term papers (77%).

Valiga and Bruderle's study published in 1994 was broader in nature than the other three studies. It was undertaken to identify those concepts included and deemed critical in A.D.N and BSN programs, and also as a means of stimulating nurse educators to think about concepts integral to nursing curricula and to clarify the meaning of those concepts (pp. 118-119). Using an exploratory descriptive survey design similar to that of Jones and Brown (1991), Valiga and Bruderle randomly selected 20 BSN and 20 A.D.N programs from each of the six regions representative of the USA. Of the 240 surveys sent, 137 (56.6%) were returned and used as part of the sample. Although the authors report many important findings worthy of consideration, only those pertaining to critical thinking are highlighted here. When asked to identify concepts included in their curricula, 97% of the BSN programs and 90% of the A.D.N programs included critical thinking. Both types of programs also included decision-making, nursing process, problem-solving, and professionalism in their list - several concepts often used synonymously with critical thinking. Despite the high percentage of programs where critical thinking was included in their curricula, only 84% of the BSN programs and 76% of the ADN programs considered critical thinking as a critical concept to a nursing curriculum (p. 121). Based on the comments offered by respondents on several of the surveys returned, the authors contend that concept of critical thinking is often linked or deemed similar to decision-making or problem-solving.

In a similar study, Videbeck (1997) sought to describe the prevailing practice associated with the outcome criteria of critical thinking in baccalaureate schools of nursing. The population of interest for this study were the 124 NLN accredited BSN programs; the sample consisted of the 55 programs who chose to return the survey. Videbeck's survey utilized a framework based on the self-study report form developed by the NLN and used by the schools of nursing in preparation for the accreditation review process. The framework used to complete the content analysis of the data was based on three main categories: definition of critical thinking, critical thinking outcome, methods of measurement and evaluation, and their respective subcategories (p. 6). Content analysis of the first category, definition of critical thinking, revealed that cognitive abilities and affective qualities were reflected in 43 of the definitions provided, whereas only cognitive abilities constituted the other 12 definitions provided by the sample. The wording provided in 26 of the definitions made specific reference to nursing. Fifty definitions used or modified an existing definition of critical thinking. The most popular definition offered was that of Watson and Glaser (1964), followed by Bandman and Bandman (1995). The third and fourth most cited definitions were those of Paul (1993) and Ennis (1985), respectively. The nineteen programs that identified the second category, critical thinking outcome, included course and/or selected program objectives as examples. Although 8 of the 19 programs provided objectives that specifically used critical thinking as one of their terms, 11 programs offered objectives which they viewed similar to critical thinking, that is, problem-solving and decision making. With the third category, methods of measurement and evaluation, Videbeck was interested in finding out whether a single or multiple method was used, the type(s) of method(s) used as well as the timing of the measurement. Eighteen programs indicated that they used only one category or type of measurement. Most programs (37) used two or more types of measurements. Twenty-nine programs indicated that they used one or more of the 44 standardized tests to evaluate critical thinking. Thirteen, used more than one test. Furthermore, 12 of the 44 tests were used when students entered and exited the program to identify a growth or difference in the students' critical thinking abilities. Twenty-six of the 44 tests were used

only at the end of the program and two of them following graduation. Finally, it was interesting to note that 39 programs used course specific measures while 17 used course specific measures combined with other categories. Twelve programs used strictly course specific measures. The major subcategories of course specific measures were written tests or examinations, clinical performance, and classroom or clinically based written assignments.

The final survey to be presented is the one undertaken by O'Sullivan, et al in 1994 and later published in 1997. The survey was returned by 237 (37.7%) of the 628 selected deans and directors of NLN-accredited schools offering BSN and MSN programs. Although some similarities existed between the focus of this survey and that of Videbeck (1997), O'Sullivan, et al (1997) were primarily interested in answering three questions: How were nursing programs progressing in meeting the outcome of critical thinking? Which strategies and techniques were faculty members using and what was their perception about the quality of these identified components? And, what issues challenged them in the implementation process? Only 25% of the 237 participant programs had completed one cycle of the planning phase, 20% had completed a cycle of implementation, and only 10% had completed one entire cycle from planning though to evaluation. They were using the findings to revise and evaluate the curriculum. As part of the responses to the second question addressing strategies and techniques, 69% of BSN programs provided definitions of critical thinking. A number of themes emerged based on the review of 70 definitions chosen at random from the ones submitted. First, it is not surprising that scientific problem-solving was the leading category, followed by the definition offered by the National Council of Excellence in Critical Thinking at 12.8%, Watson and Glaser at 8.6% and other critical thinking experts such as Brookfield, Kurfiss, and Paul at 5.7%. Thirty- six percent of the respondents did not provide a response to the question related to strategies and techniques. The remainder identified several strategies and technique, which were subsequently summarized based on their frequency. Standardized measures were the most popular (27.9%). Within this category the CCTST and CCTDI were the most prevalent at 39.1%, followed closely by the WGCTA at 31.9%. Individual

assessments such as clinical evaluation/care plans/nursing process, portfolios, and written assignments/case studies/projects were identified by 27.1% of the respondents. Lastly, surveys originating from alumni, focus groups, and student achievement questionnaires made up the remaining 4%. The last question of interest to O'Sullivan, et al referred to any issues and difficulties encountered by the programs under study and approaches undertaken to address the NLN criterion of critical thinking. The major issues and difficulties reported by both BSN and masters in nursing programs include measurement of critical thinking especially in the qualitative domain, finding a suitable definition, and faculty attitude and skills.

In conclusion, definitions and measurements seem to be major challenges for the programs due to diversity of perspectives related to critical thinking. A common finding was the link or similarities documented or believed to exist between critical thinking and problem-solving and between critical thinking and decision-making. This finding reinforces the need for ongoing dialogue to clarify the nature and interpretation of these concepts. The survey results indicate some confusion between teaching and learning, and assessment processes. The accreditation process is motivating programs to deal with the criteria. The critical thinking criterion has forced faculty groups to re-examine how they teach and encourage critical thinking. Some of the findings reinforce the need for a model that could be used to teach, assess, and measure critical thinking. Despite limitations inherent in some of these studies, and acknowledging that the level of integration of critical thinking may have been differently perceived and subsequently reported, there is evidence that critical thinking is present among NLN accredited programs.

Nurse Educators' Critical Thinking Skills

Several authors assert that role modelling by nurse educators is a key strategy to enhance and promote critical thinking skills and dispositions in nursing students (Birx, 1993; Bowers & McCarthy, 1993; Brookfield, 1993; Burnard, 1989; Ford & Profetto-McGrath, 1994; McDonald, 1996; Miller & Malcom, 1990; Paul, 1992). According to Hartley and Aukamp (1994) and Saarman, et al (1992) this belief is based on the assumption that in order to influence students' critical thinking skills and dispositions in a

positive manner, nurse educators must possess significantly higher critical thinking skills than students. This specific assumption has not been widely tested. Only three studies found in the literature specifically compare the critical thinking abilities of nurse educators with those of their students.

Jones (1992) used the Cornell Critical Thinking Test (Level Z) to assess the skills of a convenience sample of 97 senior baccalaureate nursing students and 33 baccalaureate nurse educators. The use of a t-test to assess the difference in means indicated that there was no significant difference between the student and nurse educator groups.

Using the Watson and Glaser Critical Thinking Assessment and a cross-sectional design, Sarman, et al (1992) used a convenience sample of 32 participants (based on power analysis) from each of the following groups: nurse educators, associate degree nurses (A.D.N.), baccalaureate student nurses (BSN), and sophomore college students entering nursing. Similarly to Jones (1992), these researchers found that the critical thinking abilities of nurse educators were not significantly higher than those of sophomore students, even when they controlled for the variable of age.

Unlike the two studies presented above, Hartley and Aukamp's (1994) study revealed that nurse educators had significantly ($p < .005$) higher critical thinking abilities than the students in the study. The nurse educators (N=50) were recruited from 10 programs or 67% of NLN accredited baccalaureate nursing programs in the state of Missouri. The nurse educators held either a master degree in nursing (58%) or a PhD, EdD or higher (42%) degree, held full time positions, and were responsible for classroom and clinical instruction. The scores for the critical thinking skills of the student sample (N=46) were not obtained by the researchers themselves, but were acquired from the study by Sullivan (1987) because the number of participants in his study approximated the numbers of educators recruited.

Because of the paucity of research regarding the critical thinking skills of nurse educators and the contradictory results reported by the researchers in the few studies cited above, it is premature to make any definitive conclusions.

Factors Influencing Critical Thinking and Critical Thinking Dispositions

Analyzing, synthesizing, and summarizing research studies in order to extrapolate themes, and implications for nursing education, research and practice is a daunting task. As indicated earlier in this report, several authors during the last two decades have attempted to do so for different purposes and guided by different approaches to summarize their findings. Examination of these reviews has been productive in guiding this writer to develop the most useful approach to report and discuss the existing research studies included in this section. The purpose of this review is to summarize the efforts of researchers who have investigated levels of critical thinking skills and critical thinking dispositions among nursing students, as well as the relationships between several variables or factors and critical thinking skills and dispositions. The studies reported here are grouped according to the following categories:

1) demographic and background factors or variables associated with critical thinking skills and dispositions;

2) impact of nursing education and types of programs upon the development of critical thinking;

3) teaching and learning strategies and their effect on critical thinking skills and dispositions;

4) relationship between critical thinking skills and dispositions of baccalaureate nursing students;

5) critical thinking as a correlate of success in nursing;

6) relationship of critical thinking to clinical decision-making, clinical judgement, professional nursing competence, and moral reasoning; and

7) qualitative research related to critical thinking.

Selected Demographics and the Relationship with Critical Thinking Skills and Dispositions

Age and gender are two demographic variables that have been often correlated with critical thinking. This relationship has been based on the common assumption or belief that critical thinking abilities improve as individuals age and that males tend to have higher critical thinking skills than women. For example, Alfaro-LeFevre (1995) professed

that older people were more likely to be critical thinkers because moral development often occurs with maturity and most older individuals have experienced the application of reasoning in a variety of situations. The results of most nursing research studies do not support either of these assumptions.

Only two studies (Tiessen, 1987; Behrens, 1996) reported a positive correlation between age and critical thinking scores as measured by the WGCTA. In Tiessen's study, with a sample of 150 BSN students ranging from 18-39 years [mean - 21.29 years, (p. 119)], there was low positive correlation of $r = 0.16$ ($p < 0.10$). The ages of the final sample ($N = 113$) in Behrens study were not provided; however, the majority of the population (67.7%) from which they were drawn was younger than 24 years of age. No statistics were provided to support their conclusion that a positive correlation existed between age and critical thinking.

Unlike Tiessen (1987) and Behrens (1996), several other researchers interested in the relationship between age and critical thinking found opposite results (Gross, et al, 1987; Waite, 1989; Lynch, 1988; Brooks & Shepherd, 1992; Facione, 1997). With the exception of Facione whose research was based on an aggregate data set which used the CCTST as the data collection tool, the above-mentioned researchers used the WGCTA. They all reported no significant correlation between age and critical thinking scores of students conveniently sampled from a variety of nursing programs (Diploma, BSN, A.D.N., RN Completion). Howenstein, Bilodeau, Brogna, and Good (1996) actually reported a significant, negative correlation ($r = -.25$) between age and critical thinking scores of students with diploma, A.D.N., MS and PhD educational backgrounds. Facione, reported a non-significant relationship between age and critical thinking among the students who were part of the aggregate data set. In addition, she reported that 185 students for whom entry and exit CCTST scores and age were available revealed a negative correlation ($r = -.213$, $p < .01$) within subject scores (p. 31). This finding indicates that for these cases critical thinking scores declined as the students aged over the span of their nursing program.

The relationship between gender and critical thinking was studied by Waite (1989) and many of the programs included in the aggregate report by Facione (1997). Based on a convenience sample of 299 senior BSN students, Waite found no significant relationship between gender and critical thinking skills. Concurrent with these findings, Facione found that there was no difference between male and female groups' critical thinking score means at entry level ($t = .074$, $df = 2320$, $p = .941$). Similarly, the CCTST exit mean scores of over 1000 students showed no difference ($t = .039$, $df = 1025$, $p = 0.969$) between male and female groups. In the aggregate report Facione indicated that these results are consistent with those found when she studied non-nursing college students as part of the validation studies done with the CCTST.

Level of education beyond high school has been another demographic variable of interest to some researchers interested in critical thinking. Gross, et al (1987) found that years of education were not a significant predictor of critical thinking scores of 108 A.D.N. and BSN students as determined by the WGCTA at entry ($r = .05$, $p = .05$) or exit ($r = .06$, $p = .05$).

One of the other demographic variables of interest which is not widely explored in relation to critical thinking is language of origin or culture. Gross, et al (1987) were motivated to investigate the effect of ethnic background on critical thinking because their population of interest was multicultural. They found that the highest scores on the NCLEX were achieved by Caucasians. In contrast to Caucasians and third and fourth generation Japanese, Filipino students who were newcomers to Hawaii and most likely members of families for whom English was a second language, scored lowest on the WGCTA. Based on the work completed to date by Facione and Facione (1994), the CCTST's content does not disadvantage students whose language of origin is not English. Their research indicates that native English speaking ability was significantly associated with larger gain scores; however, there was no significant relationship between language of origin and critical thinking skills overall scores. Unfortunately the aggregate report compiled by Facione (1997) does not report on the relationship between language of origin and critical thinking, most likely because the data was not available. It should be

mentioned at this time that the CCTST has been translated into several other languages; therefore, it can be utilized with a variety of individuals who may not be well versed in the English language.

Nursing Education and Types of Nursing Programs' Effect on Critical Thinking

Several researchers studied the effect of nursing education on critical thinking ability using pre-test and post-test designs, as well as the impact of different programs on the critical thinking abilities of nursing students. The studies have been subdivided into three sections: effect of nursing education on critical thinking ability using a pre-test and post-test design; the effect of various types of nursing programs (diploma, A.D.N, BSN, and MN) on critical thinking; and the effect of accelerated versus traditional programs on critical thinking.

Effect of nursing education on critical thinking ability (Pre-test & post-test design). Studies described in this section were conducted by researchers primarily to verify the impact of nursing education over time on the critical thinking abilities of nursing students In order to accomplish this goal, the researchers utilized a pre and post-test, longitudinal design to measure students' critical thinking skills at entry and at exit from their respective programs. It must be noted at the outset that with the exception of Facione (1997), who reports on studies based on the use of the CCTST, all other studies used the WGCTA. Also meaningful is the fact that none of the studies utilized a control group as part of their design. It is somewhat reassuring to note that of the thirteen studies that compose the sample for this section, only two studies reported a decrease in students' critical thinking.

Richards (1977), using a convenience sample of 72 nursing students at entry and exit of a new 2 year integrated curriculum, found a significant decrease ($t = -1.87$, $p < .05$) in scores. Although she offered no possible explanation for this decrease, Richards did recommend further investigation of the new curriculum. Notarianni (1991) included two groups from different programs in her study. The 133 A.D.N. students were tested at the beginning and completion of their first year and at the completion of their second year, that is, the end of their program. The 188 BSN students were tested at entry to year 1 and at the end of years 1, 2, 3, 4. Notarriani reported a decline in the scores of

the A.D.N. students at the end of year 2 and a decline in the scores of the BSN students at the end of fourth year. In addition there were no significant gains at the end of year one for the A.D.N. group and no significant gains at the end of years 1, 2, and 3 for the BSN group.

Five studies that reported no significant changes between entry and exit critical thinking scores were conducted by Bawens and Gerhard (1987), Maynard (1996), Saucier (1995), Sullivan (1987), and Tissien (1995). With the exception of Maynard, who used a randomly selected sample, the other researchers used convenience samples obtained from BSN and/or RN-BSN groups of students. Although all expressed surprise at the lack of gains in critical thinking only some of the authors made an attempt to account for this. Maynard raised several questions and outlined some conclusions worthy of consideration. Some of these surround the issue of measurement. First, she suggested that no one tool is sufficient to capture all aspects of critical thinking and therefore several methods should be utilized. Secondly, she questioned the appropriateness of the WGCTA as a measurement tool. This concern is shared by Bawens and Gerhard (1987) who explained that the results may have been due to the fact that the WGCTA may not be measuring the true nature of critical thinking; that is, process versus outcome.

Several of the studies summarized as part of this section do report significant, positive results and attribute them to the effects of nursing education. The results of Facione (1997) are based on the pre-test and post-test CT skills gains of 625 undergraduate nursing students who completed the CCTST. The scores of this large sample of students revealed a statistically significant gain in critical thinking skills ($t = 4.553$. $df = 624$. $P < .001$). The gain represents nearly one question difference in the correct score from pre to post-test results (p. 25). All other studies (Berger, 1984; Gross, et al, 1987; Kokinda, 1989; Miller, 1992; Poole, 1989) which used the WGCTA tool studied only BSN students or a combination of BSN, A.D.N., Diploma, and RN-BSN students. Kokinda, who used a sample of only 49 BSN students, found a gain in critical thinking skills at the end of each program year in addition to an overall gain from entry to exit. All other studies used sample sizes of more than 100 students and measured critical

thinking first at entry and then at exit. Miller, who included students from four different programs, found an overall gain for all students. Further, in Miller's study, the gains achieved by graduates from diploma programs exceeded the gains achieved by A.D.N. graduates ($t = 3.39$, $df = 76$, $p < .01$).

It is apparent that the studies outlined here produced mixed results. The differences in results may be attributable to such factors as types of measurement, length of time between pre and post-testing, sample selection techniques and sample size.

Relationship between different types of nursing programs and critical thinking. Some of the nursing research studies published in the nursing literature have focused on the level of education or type of program (A.D.N., Diploma, BSN, BSN-RN, MSN) and critical thinking skills. One of the first studies in nursing to test this type of relationship was completed by Matthews and Gaul in 1979. Using the WGCTA to measure the critical thinking skills of a purposive sample of 22 BSN and 26 graduate students (as part of a correlational, comparative design), they found no statistically significant difference ($u = 224$, $p < 0.2$) between the two groups' critical thinking abilities. The authors attributed the similarity to several factors, including educational level. They suggested that the level of education might contribute to the development of critical thinking. One of the other factors was attributed to the inability of the WGCTA to capture the graduates' critical thinking skills.

Pardue (1987) also used the WGCTA instrument to measure critical thinking in a correlational, comparative study conducted to ascertain the level of critical thinking of nursing graduates from four different programs. The graduate sample ($n= 360$) drawn from two large health care agencies was stratified and randomly selected; however, only 121 nurses who returned the instruments were included in the final sample. This final sample was composed of 24 nurses prepared at the diploma level, 27 prepared at the A.D.N. level, 33 prepared at the BSN level and 37 at the MSN level. Significant differences were found among the four groups of nurses. In addition, the WGCTA scores of nurses prepared at the BSN and MSN level were significantly higher than those of the nurses who had completed a diploma or A.D.N. program.

A comparative study of graduating BSN and A.D.N. students from private and public educational institutions was initiated by Lynch (1988) to determine whether differences in critical thinking ability existed between these two levels of students. The WGCTA (Form A) was employed to measure the critical thinking skills of 87 A.D.N. and 74 BSN students. Using ANOVA Lynch discovered that the BSN students' critical thinking scores were significantly higher than those of A.D.N. students.

In 1992, Brooks and Shepherd replicated their original study (1990). Both studies were descriptive, correlational and comparative, and used the WGCTA instrument and a convenience sample of 50 students from each of a diploma, A.D.N., BSN and Post-RN completion program. The researchers obtained similar results in both studies. Their findings indicate that the critical thinking abilities of BSN and RN-BSN students are significantly higher than those of Diploma and A.D.N. students. No significant difference was found between the critical thinking levels of BSN and Post-RN students. The finding that the critical thinking scores of BSN students are higher than those of Diploma and A.D.N. students is consistent with Pardue's (1987) conclusions.

Retsas and Wilson (1996) also conducted their investigation using a descriptive, correlational and comparative study. Their goal was to study the critical thinking skills of RNs entering a RN-BSN program or one of four graduate specialty programs. They also used the WGCTA instrument to measure the critical thinking abilities of a convenience sample of 83 RNs entering one of the four graduate diploma specialty courses in nursing (Emergency, Coronary Care, Perioperative, Community Mental Health) and 60 registered nurses entering a RN-BSN program. Their aim was to find out whether prior learning and prior university experiences used as the main pre-requisite for acceptance into the above programs were related to critical thinking. Unfortunately these authors did not clearly delineate what constituted prior learning for these students. Retsas and Wilson claimed that the existence of these pre-requisites assume that students enter programs with some level of critical thinking which may be further enhanced by the particular program. Their findings were organized according to the three hypotheses they tested. First, they found that the 19 students with some university education who enrolled in the graduate specialty

courses had higher means on the WGCTA than the 64 students who enrolled on the basis of prior learning (p. 28). Secondly, they found no significant differences between group scores on WGCTA of diploma RN graduates entering the specialty courses and diploma RN graduates entering the BSN program on the basis of prior learning. Lastly, the authors found a significant difference in the critical thinking abilities of students corresponding to the specialty courses on the basis of prior learning.

Accelerated versus traditional programs. Accelerated nursing programs have existed in some American universities since the early 1970s (Wu & Connelly, 1992). This type of program was established to offset a decrease in the number of applicants to nursing programs and to increase recruitment into nursing programs in order to satisfy the high demand for graduate nurses. The purpose of accelerated programs is to facilitate speedier progression through an existing program, usually 3 years versus 4 years for those students who enter programs with previous course work or who have previously completed a bachelor degree in a non-nursing program. Thus accelerated programs allow for quicker entry of graduates into the nursing profession. Because of the condensed length of these programs, nurse educators must be concerned with whether the graduates of these programs demonstrate or meet the same outcome criteria traditional students are required to meet. One of these outcome criteria is critical thinking. Because accelerated students have previous academic and/or work experience, it is often assumed that they are older and are more focused on their studies, and thus have higher critical thinking skills. However, very few studies have been published specifically reporting on the investigation of this specific assumption. Two nursing research studies that address the effect of accelerated programs versus traditional programs on critical thinking skills are reported here.

Using a prospective, pre and post-test design, Youssef and Goodrich (1996) explored the differences in critical thinking ability, as well as stress levels and performance, between accelerated and traditional nursing students. A convenience sample of 94 A.D.N. students, 46 traditional and 48 accelerated, who were enrolled in one program over a three year period were administered two instruments. The State-Trait

Anxiety Inventory was used to assess their stress level and the Scale of Judgemental Abilities (SJAN) was used to measure their level of critical thinking ability. The SJAN has not been widely used in nursing studies. The authors' description of this scale was very limited and they failed to include any reliability and validity information in their study. Youssef and Goodrich did indicate that the scale consisted of 28 multiple choice questions and that it appraises five classifications of understanding including comprehension, application, analysis, synthesis, and evaluation (p. 78). These levels of understanding are common components of other more widely used instruments to assess critical thinking. The results indicated that the groups were not significantly different when considering such demographics as age and cultural background. Despite the fact that 80% of the students enrolled in the accelerated program had previously achieved a bachelor's degree in another discipline and had attained significantly higher GPAs, no statistically significant difference was found in the critical thinking scores of the two groups on the pre and post-test or on the overall gains between the pre and post-test scores.

A study by Pepa, Brown and Alverson (1997) also compared the critical thinking abilities of traditional and accelerated students. Although the type of sampling technique, the type of design and the number of participants were quite similar to those described by Youssef and Goodrich (1996), these investigators utilized the WGCTA to assess critical thinking abilities at the beginning and the end of the nursing course sequence. Traditional students' pre and post-test scores indicated significant gains in critical thinking skills while accelerated students achieved non-significant albeit positive gains in critical thinking skills. The results also indicate significant differences between the test scores of the two groups ($t = -2.42$, $p = .017$) at the beginning of the nursing course sequence but not at the completion of the courses ($t = -1.76$, $p = .082$).

Teaching and Learning Strategies and Their Effect on Critical Thinking Skills and Dispositions

The literature is replete with articles and books that focus on various teaching and learning strategies aimed at developing and enhancing critical thinking (Beeken, Dale, Enos, & Yarbrough, 1997; Brookfield, 1987; Case, 1994; Conger & Mezza, 1996; Dobrzykowski, 1994; Garrett, Schoener, Hood, 1996; Glen, 1995; Girot, 1995; Johnson

& Johnson, 1988; Kemp, 1985; Martin, 1996; Meyers, 1986; Miller & Malcom, 1990; Ruggiero, 1990; Sternberg, 1985; Wasserman, 1987). Lewis and Eakes (1992) believe that teachers need to be able to identify as well as use a variety of strategies that stimulate and foster critical thinking skills and dispositions. To this end Baker (1992) conducted an exploratory study to discover faculty's understanding of the factors that contribute to nursing students' development of critical thinking. The responses of 220 (63% of original mailout) nurse educators from an American state indicated that they supported the use of those activities that required active participation on the part of the learner. These included panel discussions, seminars, and the nursing process. Another study carried out by Sander (1992) used a randomly selected sample of 1000 masters and doctorally prepared nurse educators and members of Sigma Theta Tau International. Based on 63.3% return rate, Sander contended that five major classifications of teaching and learning strategies were perceived by nurse educators as contributing positively to the development of critical thinking: simulation activities; critique; interactive activities; objective question activities; writing; and lecture. Sander's study also revealed that educators' perceptions regarding critical thinking strategies was minimally affected by their educational preparation.

This writer's findings on this subject, based on the review of dozens of unpublished and published sources, reveal somewhat similar categories as those identified by Baker (1992) and Sander (1992). The major categories formulated here are: 1) writing in the form of papers, reflective journals, concept analysis, critiques, case studies, nursing care plans, and charting; 2) role modelling by nurse educators and nurses in practice settings; 3) questioning; 4) verbal, individual and/or group activities such as presentations, role playing, interviews, discussions, structured controversies and debates, clinical rounds, problem based learning/case studies analysis, and 'thinking aloud'; and 5) computer assisted learning and simulations.

Writing as a major method to develop and enhance critical thinking and dispositions is advocated by many authors. Hahnemann (1986) believes that writing involves highly complex cognitive processes and can be used not only to communicate with others, but also to define oneself and one's convictions; to make one's voice heard.

Lantz and Meyers (1986) assert that writing engages students in generating and converting knowledge. In addition to facilitating essential inquiry, writing situates individuals in roles of "self-active" learners who are motivated to assume responsibility for their own learning. In addition, the authors believe that by having students "write continuously, we can help create the quality of mind needed for professional expertise in nursing" (p. 64). Pond, Bradshaw and Turner (1991) consider writing an important strategy to develop critical thinking because it inspires students to think in the abstract domain, to conceptualize, to interpret and to reason. Bowers and McCarthy (1993), who promote process as well as content, indicate that writing and rewriting with thoughtful and ongoing feedback allows for student and teachers to become active participants in the practice of dialogue and thus learning. Other proponents on the importance of writing to further critical thinking skills include Koch and Speers (1997), Lashley and Wittstadt (1993), and Whiteley (1992).

Role modelling is another popular teaching and learning strategy used to promote critical thinking and dispositions. It has been featured by such noted authors as Berger (1984), Birx (1993), Brookfield (1993), Burnard (1989), Case (1994), Heaslip (1994), and Paul (1992). Burnard suggests that it is crucial that nurse educators demonstrate their own critical thinking dispositions. Heaslip stresses that nursing faculty have an obligation to "model the process for the student, raise questions which challenge the student to reflect analytically about the quality of the thinking occurring, and to encourage open dialogue about the difficulties in achieving self-disciplined critical thought" (p. 32).

Questioning, the third category identified as a strategy to promote critical thinking, has also been the focus of numerous publications. Browne and Keeley (1994) have written an entire book on the subject. They believe that questioning is an active process; individuals can reach sound decisions by critically questioning what they hear, see, read, and experience. Other supporters of questioning include Craig and Page, (1981), Demetrulias and Shaw (1985), Heaslip (1994), King (1995), Lewis and Eakes (1992), Sellappah, Hussey, Blackmore, and McMurray (1998), and Wink (1993).

Problem-based learning, which is one of the strategies listed as part of the fourth category identified above, is a variable included in the present study. Problem-based learning has been increasingly used in the educational programs of various health care related disciplines as an alternative to the more traditional and widely employed modes of instruction (Branda, 1990; Frost, 1996; Newman, 1986; Norman, 1988; Norman & Schmidt, 1992; Sefton, 1997). It is described by many as an active process that stimulates the acquisition of a body of knowledge. Subsequently, learners use such knowledge when working with 'real' cases, problems or situations derived from practice (Hammes & Duryea, 1986/1987). There are many authors (Frost, 1996; Gauvreau & Kam, 1996; Graham, 1997; Hammes & Duryea, 1986/1987; Stern, 1997; Walton & Matthews, 1989) who espouse the varied benefits of problem-based learning. Hammes and Duryea, and Graham believe that this technique promotes problem-solving skills, independent and self-directed learning, and critical thinking. Others such as Stern (1997) reported the benefits to professional behavior, integration of various elements, and clinical reasoning, as identified by occupational therapy students after the completion of a problem-based course. Norman, considered one of the preeminent investigators in the area of PBL together with Schmidt (1992) conducted a review of the evidence to ascertain several of the claims associated with the psychological basis of PBL. Based on the evidence available they reached several conclusions. Three of these conclusions were as follows: "...learning in a PBL format may initially reduce levels of learning but may foster, over periods up to several years increased retention of knowledge...PBL enhances intrinsic interest in the subject matter; and...PBL appears to enhance self directed learning skills, and this enhancement may be maintained." (p. 557). Problem-based learning in the education of health care professionals is also regarded as an innovation that can bridge the gap between theory and practice (Frost, 1996).

It is surprising to find that very few of these teaching and learning strategies have been the subject of extensive research studies in nursing to ascertain whether they contribute to the development and/or strengthening of critical thinking skills and dispositions of nursing students. Nursing research studies that have been conducted to

investigate the relationship between individual teaching strategies and critical thinking skills are reported here under separate headings.

Writing as a strategy to facilitate critical thinking. Two studies conducted in the early 1990s were specifically aimed at testing the effect of writing on critical thinking skills. Neither reported statistically significant findings. Guice's (1992) experimental study was designed to test the effect of concept analysis instruction on critical thinking skills. Both the control and experimental group, each composed of senior baccalaureate nursing students, were tested using the WGCTA before and after a nursing course. The experimental group were given instruction in concept analysis. Based on ANOVA with repeated measures, the researcher found no significant improvement in the critical thinking skills between the two groups. Guice attributed the lack of significant improvement on the length of the course. He suggested that a longer period of time was needed for students to benefit from the concept analysis instruction and thus recommended a longitudinal study to test the effects of long term instruction.

Givens' study in 1990, focused on two groups of junior baccalaureate nursing students. The framework which guided this study was developed by Perry (1970); it outlined individuals' cognitive/intellectual and ethical development. Writing as a strategy was used to promote the cognitive development of the nursing students who took part in the study. Twenty-nine students who were part of one section of the same course became the experimental group and 16 nursing students in another section of the course became the control group. The writing experience was only provided to the experimental group. At the end of the semester, there was no statistically significant difference in the cognitive development between the two groups, although the development that did occur was consistent with results of other nursing students who took part in other research studies.

Reflective journals and critical thinking skills. The effectiveness of reflective journals in increasing critical thinking skills in nursing students was studied by Fonteyn and Cahill (1998). They used the work of Schon (1982) as their theoretical framework for the pilot study involving nine third year baccalaureate nursing students assigned to a variety of units in an acute care setting. Based on the logs completed over a semester of clinical

practice time (180 hours), Fonteyn and Cahill concluded that these students' overall critical thinking skills had improved. The students improved in the areas of recognizing patterns, forming relationships, generating hypotheses, providing explanations and drawing conclusions (pp. 151-153). The multiple benefits of reflective journals or logs are supported by numerous other writers including Baker (1996); Brown and Sorrell (1993); Degazon and Lunney (1995); Hahnemann (1986); Lashley and Wittstadt (1993); and Sedlak (1997).

Two other studies conducted by Richardson and Maltby (1995) and Wong, Kember, Yung and Chang (1995) focused primarily on discovering the benefits of this strategy for second year baccalaureate students and the level of reflective practice by a group of registered nurses. Unfortunately these two studies did not specifically address the relationship between critical thinking and reflective journals. Nonetheless, the findings reported by these researchers do reinforce the importance of reflective thinking as part of nursing education and practice. Furthermore, both studies provide enough information about the instruments and methodology to allow for easy incorporation of this work into future studies. The aim will be to investigate the link between critical thinking and reflective thinking in nursing education as well as practice.

Questioning and critical thinking skills. Teachers' use of high-level questions and probing questions, to influence students' critical thinking were incorporated into a study to ascertain the effects of selected discourse strategies by Rossignol (1997). Discourse strategies were conceptualized by the author as teacher-centred and student-centred techniques. These were employed as part of the dialogue to cultivate student critical thinking by prompting students to utilize higher-order cognitive skills. High level questions in this study were described as those which used the cognitive levels of application, analysis, synthesis and evaluation. Rossignol utilized a convenience sample of students from a NLN accredited BSN program. Ten clinical groups were surveyed with a final student sample of 57 (70% of original group). Three randomly audio-taped clinical post-conferences for each of the participating groups comprised part of the data collection. The WGCTA was used to measure the final sample of students. The group

mean for critical thinking was 55.54 (SD=8.26, SE=1.094). The teachers' level of questions were identified by coding the audio-taped transcripts. The results indicated that the teachers' use of high-level questions was significantly associated with the students' critical thinking skills.

Other researchers have also indicated that nurse educators' use of cognitively high level questions do influence students' abilities to formulate and subsequently answer high level questions. In their literature review, Sellappah, et al (1998) and Wink (1993) identified only a few studies (Craig & Page, 1981; Malcomson, 1990; Scholdra & Quiring, 1973) that explore the level of questions used by nursing faculty. The study by Craig and Page, published in 1981, was part of a paper which focused on the questioning skills of nursing instructors. Based on their own beliefs as well as those of others whom they included in their article, Craig and Page were decisive about the importance of this skill for nurse educators. They conducted an experimental study using a pretest-post-test control group design to investigate the effect of a self-instructional module on questioning. In their study they discovered that the module increased the use of high level questions asked by nursing instructors by 35% as compared to 20% for the control group. Similar findings were shown by Wink (1993) based on a quasi-experimental, pretest-post-test treatment and control group design. The treatment in this study was a program specifically designed to raise the percentage of cognitively high questions asked by faculty and students. The difference in the level of questions asked by faculty and students before the intervention was not statistically significant. Post-intervention showed a statistically significant difference between nurse educators in the treatment group and those in the control group; however, there was no statistically significant difference between the nursing students in the two groups.

In their 1998 study, Sellappah, et al found that clinical instructors used more low level questions (91.2%) than high level questions (4.4%). Nurse educators' academic qualifications and years of clinical experience were not significantly related to the number of high level questions they asked. Based on these findings, the authors provided several recommendations. These were based on their belief that high level questions such as

analysis, evaluation and synthesis correspond with the development of critical thinking skills.

Problem-based learning and critical thinking skills. Despite the fact that problem-based learning has been in existence for many years, the literature search on this approach in health care professionals' programs in the 1990s produced only eighty-nine references. Of these, only six references were research-based, and only two were in nursing.

The purpose of the study by Carpio, O'Mara and Hezekiah (1996) was to establish which variables were the best predictors of success on the Canadian Nurses Association Testing Services (CNATS) examination. Twenty percent of the questions in the CNATS examination target the graduate nurses' critical thinking abilities, and 4-8% of the questions target the affective domain (receiving/responding, valuing, organization and characterization) and other aspects of nursing knowledge (p. 11). This retrospective study was conducted with 114 baccalaureate newly graduated nurses from a four-year integrated, problem-based program. Using stepwise regression equations, the researchers found that the graduates' nursing average based on problem-based courses was among the list of best predictors for success on the Canadian licensure exam.

The nursing study by Sandor, Clark, Campbell, Rains and Cascio (1998) evaluated the influence of a scenario-based community health course on the critical thinking skills of 54 senior baccalaureate nursing students. They chose a pretest-post-test, one group design to test three hypotheses, one of which was associated with the effect of the scenario-based course on critical thinking. The WGCTA Form A and B were used to measure the students' critical thinking skills at the beginning of the course and at the completion of the course, seven weeks later. Based on the students' pretest and post-test scores achieved on the WGCTA, the authors found a significant difference in the overall critical thinking scores [f(1, 53), = 10.23, p = .0024] and on two sub-scales: interpretation [f(1, 53), = 7.79, p = .007] and evaluation [f(1, 53), = 29.786, p = .0001]. They asserted that although the scenario allowed the students opportunity to weigh the evidence and decide whether generalizations of conclusion were warranted (interpretation) and distinguish between those arguments that are weak or irrelevant and those that are strong

and relevant (evaluation), the scenarios were too broad and general to facilitate changes in the sub-scales of inference, assumptions, and deduction. In further studies Sandor, Clark, Campbell, Rains and Cascio recommended designing the scenarios so that they would contain more essential and important information.

CAI and critical thinking skills. Percifel and Nester (1996) conducted a quasi-experimental study to compare the effect of computer-assisted instruction (CAI) and the effect of traditional instruction on 83 baccalaureate nursing students' critical thinking skills during a psychiatric clinical rotation. They found that the group who used CAI (N = 39) scored significantly higher on several aspects associated with critical thinking compared to the control group (N = 44).

Yuill (1991) was also interested in studying the effects of CAI on critical thinking of BSN students. Yuill used a two by two repeated measure design with a convenience sample of 30 participants randomly assigned to either an experimental or a control group. The investigators concluded that CAI had no impact on critical thinking as measured by the WGCTA, which was administered as a pre and post-test.

Relationship Between Critical Thinking Skills and Critical Thinking Dispositions

Although descriptors that could be utilized to qualitatively assess individuals' habits of mind or dispositions have been described in the literature, quantitative research studies investigating the specific relationship between critical thinking and critical thinking dispositions in nursing are few. However, subsequent to Facione and Facione's (1992) development of the first instrument to quantitatively measure dispositional traits, some studies detailing this important relationship are now beginning to emerge.

Colucciello (1997) conducted a cross-sectional, descriptive, comparative, and correlational study with a convenience sample of 328 baccalaureate nursing students. The purpose of her study was three-fold. In addition to her interest in finding out the students' critical thinking skills and dispositions, and their differences based on academic levels, she was also interested in discovering if a relationship existed between critical thinking and dispositions. Her findings are based on the scores yielded using the CCTST and CCTDI. First, her findings indicate that the sophomore nursing students obtained an overall score

of 290.90 which was significantly lower than the overall scores obtained by junior and senior nursing students ($F = 8.86$, $p = \leq .0000$). The lowest reported sub-scale scores for all levels of nursing students was that of truth-seeking. The individual group means and the total mean for all groups combined were all below 40 (recommended target score). Colucciello also found that a significant positive relationship existed between the students' critical thinking skills and their critical thinking dispositions ($r = .32$, $p = \leq .01$).

Similar findings were identified by Facione (1997) in her report based on a composite data set consisting of 145 undergraduate samples from 50 nursing programs drawn from all parts of the United States. The total number of cases included was 7,926. The overall scores for the majority of students in all levels of baccalaureate programs are above 280; very few students obtained scores lower than 210. She also reported that the scores on the truth-seeking sub-scale are cause for concern because the recommended target score of 40 is seen at the 60th percentile for sophomore and 70th percentile for both juniors and senior nursing students. Based on a sample of 1557 students who completed both instruments at the beginning of their programs, Facione found a positive correlation ($r = .201$, $p < .001$). In addition, a sample composed of 793 students who completed both the CCTST and CCTDI at the end of their program showed a positive, albeit low correlation ($r = .169$, $p < .001$). The relationship between critical thinking dispositions and critical thinking skills is described as a global correlation.

Critical Thinking as a Correlate of Success in Nursing

Several of the studies discussed as part of this literature review reported their findings about critical thinking skills of nursing students to: address several different purposes; test hypotheses; and provide the answer to numerous questions of interest. One of the areas of interest is the use of critical thinking scores as a predictor of success in nursing, whether that success has been measured in the form of GPA, NCLEX scores or generic success in a nursing program. One might ask why the prediction of success is so crucial in nursing education. Bauwens and Gerhard (1987) who used the WGCTA to predict success in a baccalaureate nursing program offered several reasons. They indicated that knowledge of predictive measures may be useful in guiding admission

procedures, counselling approaches, and providing remedial activities at the individual or group level. In addition, predictive measures may also be useful in monitoring students' progress and reducing unnecessary attrition (pp. 278-279). Tiessen (1987) also added that if critical thinking can indeed predict the success of students, then nurse educators could use this knowledge to re-examine their teaching and learning method to enhance the students' success. With the exception of Facione's (1997) aggregate report based on critical thinking scores derived from the use of the CCTST, all other studies used the WGCTA to measure critical thinking. The report for the NCLEX is based on a pass or fail, and the source of the GPA (high school, transfer, nursing courses, general courses) has been specifically defined within each of the studies in relation to their purpose and focus.

Most of the researchers of the studies included here reported a significant relationship between critical thinking scores and GPA and/or critical thinking scores and NCLEX results. Using multiple regression analysis Tiessen (1987) concluded that there was a low but positive correlation ($r = .32$, $p < .05$) between critical thinking and GPA of 150 baccalaureate nursing students divided among the four levels of the program. In her discussion, Tiessen reflected on some very important questions about the meaning of GPA. She asked "...could it be students' ability to read or impress the teacher? Is it a measure of the art of test-taking or one's intelligence in expending the effort to study?" (p. 122).

Behrens (1996), who recruited three different groups of freshman diploma nursing students to compose a convenience sample of 113, found a similar significant correlation between critical thinking scores of the three groups and GPA ($r = .59$, .529, and .511, $p < .01$). In his discussion, Behrens raised doubts about the predictive powers of one single measure to forecast the success of nursing students, acknowledging that nursing programs entail the learning of numerous cognitive and affective skills, knowledge and other processes.

Miller (1992) was interested in the relationship between the post-test WGCTA scores and the GPA computed by grades from nursing courses, as well as the GPA

computed by grades from all other courses. The convenience sample of 137 BSN/RN students obtained mean GPA scores of 3.60 for nursing courses and a mean of 3.44 for all other courses. These GPA mean scores differed significantly but only the nursing GPA was significantly correlated with the critical thinking scores ($r = .204$, $p < .05$). A possible explanation prudently offered by Miller suggested that the nursing curriculum provides greater contribution to the development of critical thinking skills than the non-nursing education component. A positive relationship between critical thinking scores and GPA was also reported by Waite (1989) in her study of senior nursing students recruited from the majority (92%) of baccalaureate nursing programs in the state of Wisconsin.

Bauwens and Gerhard's (1987) correlational study of several variables, including critical thinking, GPA scores at various points, and NCLEX scores, revealed some interesting findings. The sample was composed primarily of generic baccalaureate female nursing students whose highest level of education at entry was high school and whose mean age was 24 years. The researchers found that entry level GPA and entry level critical thinking were significantly correlated with exit GPA and level of critical thinking. Both critical thinking scores and entry GPA were significant in predicting NCLEX scores ($r = .42$ and $r = .38$, $p < .005$ respectively). Furthermore, Bauwens and Gerhard indicate that 22% of the variance in NCLEX scores was explained by entry level critical thinking scores and GPA. The critical thinking scores and GPA at graduation were also positively correlated ($r = .50$ and $r = .52$, $p < .005$ respectively) with NCLEX scores. These results provide some support for the use of entry level critical thinking and GPA scores as predictors of success in nursing.

Similar results were also reported by Gross, et al (1987) for BSN students but not for A.D.N. students. The entry and exit level critical thinking scores of the BSN group were positively correlated with their cumulative GPAs ($r = .32$ and $r = .35$, $p < .05$); no correlation was found between A.D.N.'s critical scores and cumulative GPA. Only the exit critical thinking scores of the BSN group were positively correlated with the NCLEX ($r = .38$, $p < .05$). The entry level critical thinking scores for both the BSN and A.D.N students were not predictive of students' success on the NCLEX. These authors attribute

the findings related to the BSN to the students' knowledge base and more extensive academic experience. For Gross, et al these findings also confirmed that the baccalaureate degree should be the minimum level for entry into professional practice.

The aggregate data analysis completed by Facione (1997) also dealt with critical thinking as correlated to GPA and NCLEX results. The data provided by the participating programs afforded Facione the opportunity to correlate critical thinking scores with several different GPAs: college admission, nursing admission, current college, senior exit and nursing exit GPA scores. The number of subjects within each of these groupings ranged from 61 in the nursing exit group to 1407 for the current college GPA group. All five different types of GPAs indicate significant relationship with critical thinking scores (p. 39). The strongest correlation was reported between nursing exit GPA and exit scores for critical thinking ($r = .596$, $p = .002$).

As part of the preamble to the report of the relationship between critical thinking and NCLEX results, Facione (1997) points out that "Foretelling a given student's success on the NCLEX is always a risky adventure because of the many factors that contribute positively or negatively to success on this examination." (p. 41). The analysis was based on 163 reports of pass or fail information provided regarding the NCLEX. Of these, the 155 students who were successful on the NCLEX achieved a CCTST mean score of 17.02 out of a maximum achievable score of 34; whereas, the 8 unsuccessful students achieved a CCTST mean score was of only 12.00. The difference in these mean scores was statistically significant ($t = 3.267$, $df = 162$, p. 001) (p. 41). Closer examination of each individual student's score confirmed a very poor performance (10 or lower) on the CCTST by 5 of the 8 unsuccessful students. By contrast only 7 of the 155 successful students achieved scores of 10 or lower.

Only one study reported no significant relationship between critical thinking scores and GPA. The study conducted by Berger (1984) used a descriptive correlation design and a convenience sample of 137 sophomores enrolled in a baccalaureate nursing program. Although the students' critical thinking scores in their senior year, as measured by the WGCTA, increased significantly from their sophomore year, their critical thinking

scores were not significantly correlated with their nursing GPA (r = .139) or science GPA (r = .219). In as much as she acknowledged some limitations in her study, Berger offered no plausible explanation for these findings nor did she address any implications for the reader's consideration.

Generally, critical thinking scores seem to be significant predictors of success in nursing programs as measured by GPA and NCLEX pass/fail results. However, additional studies are needed to further strengthen this conclusion before such measures are routinely used to predict success in nursing.

Relationship of Critical Thinking to Clinical Decision Making, Clinical Judgement, Professional Nursing Competence, and Moral Reasoning

In a practice discipline such as nursing it stands to reason that nurses entering the profession are competent practioners who are able to make sound decisions about many aspects related to patient care, reason morally and ethically about key questions and issues facing the profession and society, and embody those qualities and skills considered as core to each professional. Many authors believe critical thinking optimizes these aspects of professional nursing practice (Beck, Bennett, McLeod, Molyneaux, 1992; Gillmore, 1993; Jones & Brown, 1991; Owen, 1997; Profetto-McGrath & Myrick, 1996; Snyder, 1993) and believe that critical thinking is a necessary aspect. Studies, albeit few in number, have been completed to specifically study the relationship of critical thinking to clinical decision making, clinical judgement, moral reasoning, and professional competence.

Critical thinking and clinical decision making, clinical judgement, and professional nursing competence. Studies exploring critical thinking's relationship to either clinical decision making, clinical judgement, and professional nursing competence were carried out by Bechtel, Smith, Printz, and Gronseth (1993), Brooks and Shepherd (1990), Matthews and Gaul (1979), Maynard (1996), Pardue (1987), and Tanner (1987). Matthews and Gaul's study was conducted to investigate the relationship between critical thinking and clinical judgement using the WGCTA and researcher developed case studies. They found no significant relationship between the two variables. The lack of relationship

may have been due in part by the small purposive sample of 48 BSN and graduate students.

Tanner (1987), an avid supporter of the need for critical thinking in nursing, also made use of the WGCTA to measure critical thinking. She found that these scores were not significantly correlated with the clinical judgement of 54 senior baccalaureate nursing students (as cited in Adams, Whitlow, Stover & Johnson, 1996; Kintgen-Andrews, 1991).

According to Brooks and Shepherd (1990), the research literature on clinical decision making was scarce at the time that they conducted their study. They conducted their investigation to ascertain the relationship between critical thinking and decision making among participants from four different programs. They used a convenience sample of 200 senior nursing students evenly divided among the four programs (Diploma, A.D.N., BSN, BSN/RN). They used the WGCTA to assess critical thinking and the Nursing Performance Simulation Instrument (NPSI) to measure decision making. They found a low, significant, positive correlation ($r = .249$, $p = .05$) between these two processes.

In their study, Bechtel, et al (1993) used the WGCTA and the Clinical Decision Making in Nursing Scale (CDMNS) developed by Jenkins (1987), to study 46 RNs chosen using a stratified random sampling technique. This homogenous group of RNs were part of a Career Advancement Program (CAD), had an average of 10 years of clinical experience in specialty areas, and described their educational levels as A.D.N., diploma, and BSN. In addition, close to 80% of these nurses considered themselves at the proficient or expert level as outlined by Benner. The results of this study are somewhat discouraging but not entirely surprising. The authors reported that there was no statistically significant difference between nurses' perceived clinical competence based on Benner's categories and WGCTA, and no significant difference between clinical competence and CDMNS. Furthermore, no correlation was found between years of experience and scores on critical thinking assessment or the CDMNS ($r= .27$). As well, areas of specialty practice were not correlated with either critical thinking or clinical judgement scores.

Pardue (1987) also studied a group of RNs. Her sample was also selected using a stratified random technique and comprised a total of 121 nurses whose educational backgrounds were diploma, A.D.N., BSN and master's level. In addition to using the WGCTA as one of the measurement tools, Pardue specifically developed a self-reporting decision making tool. Although most participants considered themselves superior decision makers, the findings indicated no significant difference between their critical thinking and clinical decision making. These findings correspond with the findings by Bechtel, et al (1993). The nurses ranked experience and knowledge as the top two factors influencing their decision making. Factors such as values, role models, and stress were ranked lower. Pardue used these findings to provide several recommendations for nurse educators as well as researchers. One recommendation worthy of inclusion is the importance and need of clinical practice experience in addition to strategies that enhance the knowledge base of clinical decision making. Computer assisted instruction (CAI) is one such strategy.

Maynard (1996) analyzed the relationship between critical thinking and professional nursing competence. Professional nursing competence was defined based on Benner's stages of skill acquisition and measures of performance on the Six Dimension Scale of Nursing Performance (6-D Scale) developed by Schwirian in 1978. Maynard utilized a repeated measure design on a randomly selected, cross-sectional sample of baccalaureate nursing graduates (p.14). Using a correlation matrix for critical thinking, Benner's scale and 6-D Scale based on N=24, Maynard found that critical thinking did not have an influence on nursing competence. This finding begs the questions "Can nurses develop competence toward expert levels of practice independently of critical thinking?" (p. 17); Do these measurement tools adequately appraise what each claims to measure? If not, what is the most appropriate way to capture these aspects of professional nursing practice?

Critical thinking and moral reasoning. Ketefian (1981) replicated her own study on the relationship of critical thinking to moral judgement by engaging 79 RNs recruited from three major acute care centers. Thirty-six of the RN sample were educated at the A.D.N. or hospital diploma levels, and 43 held BSN degree or higher. Critical thinking

was measured by the WGCTA and moral judgement was measured using the Rest's Defining Issue Test (DIT) (1974). Ketefian used Rest's definition of moral reasoning as a "cognitive and developmental process of reasoning depicting a sequential transformation in the way social arrangements are interpreted..." (p. 100). Rest also indicates that moral judgement development is used synonymously with moral reasoning. According to Ketefian, the DIT is highly structured and includes hypothetical stories surrounding a moral dilemma (p. 101). The study results indicated that the level of moral reasoning was likely higher if the level of critical thinking was also high. The levels of moral reasoning and critical thinking were found to have a positive, significant correlation ($r = .5326$, $p = .001$). It was also found that there was a significant difference between the scores of RNs prepared at the A.D.N. and diploma level and those prepared at the BSN and beyond. This finding together with the positive predictive power of education and the significant relationship between critical thinking and moral reasoning reinforced the assertion that nurses educated at the baccalaureate and beyond have advanced skills. In this study critical thinking and education explained 32.9% of the variance in moral judgement (p. 102).

A study conducted by Fleeger (1987) as reported by Beck, Bennett, McLeod and Molyneaux (1992) also investigated the relationship between critical thinking and moral reasoning. Fleeger used the same tools as those employed by Ketefian (1981): the WGCTA and DIT. The sample in this study included 91 students from years 3, 4, and 5 of a five year baccalaureate program. Although there was an overall low, positive relationship between critical thinking and moral reasoning ($r = .28$, $p = .004$), the levels of critical thinking and moral reasoning of the three groups of students did not differ significantly.

Qualitative Research Related to Critical Thinking

Only a few studies obtained and scrutinized for inclusion in this study's literature review used primarily a qualitative methodology. The studies included here were conducted by Lewis and Eakes (1992), Sedlak (1997), Haffer and Raingruber (1998) and Myrick (1998).

Lewis and Eakes (1992) addressed the role of critical thinking in responding to one of the controversial questions often raised in practice and one worthy of in-depth exploration and discussion: "Should nurses be required to administer care to AIDS patients?" (p. 136). This question was posed to two classes of senior baccalaureate nursing students (N=40, 36 generic and 4 RN-BSN students) enrolled in an issues course. The AIDS-related question served as the stimulus for the students' two-page assignment during the last three weeks of the semester and in a one week period of time. The papers were graded using a 10-point scale based on a clear position statement and presentation of rationale supporting the position based on theory. Following the grading and return of papers the students were engaged in a discussion of their responses and rationale. The complex nature of this question was reflected in the diversity of responses provided by the students. The majority (75%) of students responded that nurses should be required to provide care to patients suffering from AIDS. Fifteen percent of the students indicated that nurses should not be expected to care for AIDS patients. The smallest number of students (10%) conveyed feelings of ambivalence in their writing. A multitude of factors were cited by the students to support their position. The use of critical thinking skills used in both the writing process and the follow-up discussion is crucial in addressing questions and issues faced by nurses on a daily basis.

The work of Sedlak (1997) was recently published in the Journal of Nursing Education. Her interest in pursuing this study stemmed from her claim that "little research has focused in students' in-depth perspectives on their initial clinical experiences and the development of critical thinking abilities" (p. 12). She utilized Paul's (1993) work associated with the three critical thinking dimensions as the theoretical framework for the study. These dimensions are elements, abilities, and traits of reasoning. Sedlak's results were based on the analysis of three sources of data: journals, interviews and non-participatory observations in a simulated clinical setting. The data analyses consisted of data processing, major themes identification, data comparison, and data integration in the form of case study. The seven participants who were chosen from a pool of 26 students using purposive sampling technique comprised full-time female students between the ages

of 20 and 33. The major emerging themes as reported by Sedlak, which are congruent with the teaching experiences of this writer's work with beginning nursing students, were: "1) development of the professional self-perspective with orchestration of the emotional self, 2) development of a perfectionist perspective, 3) development of a caring perspective, and 4) development of a self-directed learning perspective" (p. 14).

This writer supports Sedlak's recommendations and conclusions. Nurse educators need to rely on a variety of strategies to examine students' use of critical thinking and reflection in clinical practice. More specifically, nurse educators must focus on broader methods that promote rather than restrict dialogue and tap into the richness of students' subjective experiences. A second recommendation is that an environment which is supportive, caring, and non-judgemental fosters students' critical thinking as part of the reflective process and promotes the development of students as individuals or professionals.

An interpretive phenomenological approach was utilized by Haffer and Raingruber (1998) to arrive at a initial comprehension of students' experiences in developing critical thinking and clinical reasoning. Fifteen students who were part of a clinical reasoning course participated in the study. Videotapes, reflective logs and scenario based class discussions were used to capture students' descriptions of their reasoning and responses to the reasoning of others. Initial investigation revealed that students were quite apprehensive about their initial nursing practice experience. Diminished confidence and self-doubt affected the students' reasoning in a significant way. As a result of the work completed during the reasoning course the students reported a shift from confidence-diminishing to confidence-enhancing experiences and understanding in six primary areas. For example, lack of confidence in their ability to question was initially identified as one of the areas diminishing their confidence in practice. As a result of the course this lack of confidence changed to discovering power in questioning. The fact that confidence emerged as a significant overall theme of students' experiences confirmed in part observations of this writer during years of work with undergraduate nursing students in practice. Congruent with earlier studies on the importance of questioning to promote

critical thinking and sound clinical judgement, Haffer and Raingruber emphasize that "Nursing pedagogy should encourage students to develop the habit of asking questions and of challenging perceptions of the status quo." (p. 68). Furthermore, rather than inquiring about what the students should know, educators should guide students in identifying what they should know, what they think they need to know, and how they plan to seek answers to their questions.

The final study to be included in this section was conducted by Myrick (1998). According to her work, even though preceptorship has become a leading teaching strategy chosen by nurse educators, there is no conclusive evidence about the effect of preceptorship on the clinical performance of nursing students. Furthermore, Myrick attested to a lack of research pertaining to the role of preceptorship in advancing critical thinking. She used a grounded theory approach to explore the role of preceptorship in developing and promoting baccalaureate nursing students' critical thinking skills. Participants in her study were dyads of fourth year baccalaureate nursing students and their preceptors. Her study revealed that the process of enabling (characterized as an interpersonal or interactive process) was used by preceptors to provide their students with occasions in the practice setting to enhance their critical thinking skills. This process includes the components of "climate" and "bringing about". The climate was described as the "context in which the preceptorship relationship" took place (p. 57). The bringing about reflected the preceptor's fostering of the preceptee's critical thinking abilities when they provided nursing care. Myrick has used her research finding to make several thoughtful recommendations about the role of faculty and the need for further research (pp. 115-118).

These few qualitative studies serve to illuminate how much can be learned about the critical thinking abilities of nursing students. These studies also serve as a stimulus to conduct further research studies which utilize qualitative methodologies in addition to quantitative approaches. It has become abundantly clear to this researcher that the assessment and development of a complex and abstract concept such as critical thinking needs to be captured using a multitude of techniques.

Summary and Conclusions

Several categories were used in this literature review to organize both theoretical and empirical works relevant to critical thinking and the focus of this research study. A number of summary statements and concluding remarks are offered for the reader's consideration.

- While there are several models which attempt to conceptualize critical thinking in nursing education and practice, very few of these models have been the subject of any research studies. Although these models are grounded on the works of experts in the areas of critical thinking, they need to be studied to ascertain whether the propositions offered are indeed valid.
- Various authors offered definitions and descriptions of critical thinking and dispositions. Their work seems to indicate agreement about the dispositions to critical thinking and what these might be. However, there seems to be no one 'correct' way to define or describe critical thinking. Despite the similarities among some of the critical definitions, several differences do remain. The lack of a commonly accepted definition/description is viewed by some authors as problematic. It is apparent that some view critical thinking as a process while others view it as a set of specific skills. Because of this diversity in defining/describing critical thinking, it is doubtful that a consensus will ever be achieved.
- The perceived lack of consensus by some authors has been attributed in part to issues related to measurement. Concerted effort and collaboration on the part of the experts in measuring critical thinking may be useful in overcoming some of the identified barriers. Although current instruments are deemed adequate for assessing critical thinking, Maynard (1996) and others contend that a variety of methods are needed to capture the complexity of critical thinking. Triangulation of methods has been suggested or alluded to by some authors.
- Five instruments to measure aspects of critical thinking are available. Reliability and validity of these instruments have been appropriate. The WGCTA continues

to be the most popular instrument; however, since the development of the CCTST and CCTDI more researchers have utilized these tests to evaluate critical thinking and critical thinking dispositions.

- Several untested strategies have been identified as developing, enhancing, promoting, and influencing critical thinking.
- Numerous studies have been conducted to verify the impact of nursing education on the critical thinking abilities of nursing students. The results are mixed: some studies report an increase in critical thinking, and some reflect no change. Some studies record a significant decrease in the critical thinking scores, while others indicate mixed results based on the different programs from which samples were drawn. Several factors have been identified as causes to these mixed results. Additional replication studies are warranted in this area.
- Most authors caution generalizability of the study results due to various limitations such as sampling technique, sample size, and type of design. Lack of pre-test, lack of randomization, and failure to control extraneous variables in some studies have proved to be problematic.
- A few authors have studied the relationship of critical thinking to clinical decision making, clinical judgement, professional nursing competence, and moral reasoning. Although the instrument to measure critical thinking has been somewhat consistent, the tools to measure the clinical related processes have varied. In addition, the formation of valid conclusions is precluded by a lack of replicated studies with larger groups and randomly selected students.
- The study designs have been primarily exploratory or descriptive and correlational or descriptive using small and convenience samples of students. The quasi-experimental study design has been used infrequently. Only one replication study (Ketefian, 1981) has been reported in the literature. Qualitative methodologies also need to be utilized alone or in combination with quantitative methodologies to better capture the holistic view of critical thinking.

CHAPTER 3

Design and Methodology

Description of Research Design

A cross-sectional, descriptive, correlational design was used to describe and examine critical thinking skills of baccalaureate nursing students, their dispositions toward critical thinking, and specific variables that may be associated with critical thinking. Relationship between scores on the overall critical thinking disposition inventory and the critical thinking skills of the students were explored. That is, as the disposition to critical thinking increases, does critical thinking also increase? Relationships among age, gender, language of origin, level of education, year of nursing program, experience with problem-based learning, and prior enrollment in courses related to critical thinking, were also examined as predictors of critical thinking skills.

Population/Sample

The population of interest for this study included all basic undergraduate students enrolled full-time in the four year baccalaureate nursing program at the Faculty of Nursing, University of Alberta. All full time students were pursued as potential participants in order to obtain a comprehensive assessment. Because it was anticipated that the total population of nursing students would be motivated to participate in the study, a power analysis to determine sample size was not calculated prior to the data collection phase; however, it was calculated during the statistical computation phase of the study.

Sample Access Procedures

Following permission to access the population of nursing students (Appendix C) and approval by the Faculty of Nursing Ethics Review Committee (Appendix D), each nursing student in every year of the program received a letter introducing them to the study. The introductory letter (Appendix E) included general information about the investigator, the nature of the study, the time of year and place where the study was to be conducted, and information about confidentiality associated with the data.

Using the 1996-1997 academic year teaching assignment list, nurse educators assigned to teach nursing courses in the four years of the undergraduate baccalaureate

program were contacted to inform them about the study and to request a date and time when the investigator could access the students in their class in order to administer the questionnaires. The necessary combination of course instructors were approached to access students in all years of the program and to minimize any overlap. Once the dates and times were scheduled to access all of the students in the program, a comprehensive schedule was compiled. The schedule spanned an eight-week period between March 1 and April 25, 1997, the end of the academic year. A letter of confirmation detailing the specific date and time for data collection in each course was sent to the respective nurse educator. The investigator visited each class at the designated date and time to administer the three data collection instruments discussed below. The purpose of the study, the amount of time required to complete the instruments, and ethical considerations were reviewed with each group of students prior to the administration of the instruments. Time for questions was also made available.

Sample Size and Response Rates

The participants in this convenience sample were part of the total population of 649 nursing students. Of the total population of students, 228 nursing students (35.13%) chose to participate in the study. The number of nursing students and corresponding percentage participation based on the year of the program were as follows:

Year 1 - 38 out of 101 (37.62 % response rate)
Year 2 - 53 out of 98 (54.08 % response rate)
Year 3 - 57 out of 208 (27.40 % response rate)
Year 4 - 80 out of 242 (33.05 % response rate)

With the exception of Year 2 students, the percentage of Years 1, 3 and 4 students who participated was less than 50%. The low level of participation was somewhat surprising to this researcher for a number of reasons. First, the study was conducted during class time and thus did not necessitate that students provide additional time from their schedule; secondly, there were no exams scheduled during the time of data collection which may have impacted negatively on their willingness to participate; and thirdly, there was a personal benefit to their participation. It is also interesting to mention that if students

were not informed in advance of the data collection date, there was an increased likelihood of participation when the researcher arrived to request their participation in the study.

Protection of Human Rights

Administrative approval and support was obtained from the dean of the faculty where the study was completed prior to obtaining ethical clearance. Ethical approval was granted by the Ethics Review Committee of the Faculty of Nursing, University of Alberta.

Ethical Considerations

Informed Consent Procedures

The participants were informed about the consent procedure before the investigator began collecting data. The researcher used a script (Appendix F) to ensure consistency in the approach for each data collection session. Subjects were informed that they had the right to refuse to participate in the study, and they were assured that refusal to participate would not affect their progress in the program in any way. Students who chose not to participate in the study indicated their choice by leaving the room where the study took place. Participants were informed that they could withdraw from the study at any time subsequent to data collection by informing the researcher of their decision to do so. There was an opportunity for participants to read information prior to signing the consent and for their questions to be answered by the researcher. Each subject taking part in the study signed a consent (Appendix G) prior to data collection. Participants retained a copy of the consent. Non-participants were not penalized in any way. The consent form indicated that if the participants' responses were to be used again for future studies, required approval would be obtained from the appropriate ethical review committee.

Confidentiality and Anonymity

Data collected during the study was handled confidentially. The researcher and her supervisor were the only individuals who had access to all of the original raw data. Study data were grouped for reporting purposes and no names were used in the analysis or discussion of the results. Identification numbers were used for all data collection and optical scoring purposes. The cards containing participants' names and respective ID

number were destroyed after the profiles were sent to them. No record of names have been retained, other than on the consent forms.

Storage of Data

All completed answer sheets recording participants' responses to the critical thinking skills test and critical thinking disposition inventory, background/demographic questionnaires, signed consent forms and computer discs will be retained in a locked file while not in use and will be stored for a minimum of seven years in accordance with university policy.

Measurement Tools

The three data collection tools used for this study were the California Critical Thinking Skills Test (CCTST), the California Critical Thinking Disposition Inventory (CCTDI), and the Background/Demographic Data Questionnaire. The CCTST and CCTDI were chosen for several reasons. First, the instruments are the most current ones available. Secondly, both instruments are based on the APA discipline neutral and comprehensive consensus definition arrived at by 46 individuals representing a variety of disciplines including nursing. Thirdly, the reliability and validity for each of the tools has been well documented and is reported to be appropriate for new tools. Fourthly, members of the California Academic Press, where the tools were purchased, provide free consultation services at any time throughout the research process. Lastly, research measuring critical thinking dispositions and skills of Canadian nursing students using the CCTST and CCTDI is limited, affording the researcher to complete original and needed research.

California Critical Thinking Skills Test (CCTST)

The CCTST was first published in 1990. It is used to measure the participants' critical thinking cognitive skills (Facione, 1997). This standardized test is composed of 34 intellectually challenging multiple choice items (Appendix H). The CCTST consisted of six scores including an overall critical thinking score and its related five sub-scales. These sub-scales encompass analysis, evaluation, inference, deductive reasoning and inductive reasoning. The analysis, evaluation and inference sub-scales are based on the

conceptualization of the APA Delphi report.

The *analysis* sub-scale of the CCTST reflects two meanings. First it reveals an individual's comprehension and expression relative to the importance of various elements, situations and meanings. The individual is able to achieve this comprehension through the sub-skills of categorization, decoding, and clarification. Secondly, analysis reflects the subject's ability to "identify the intended and actual inferential relationships among statements, questions, concepts, beliefs, or judgements," (p. 9) which includes the sub-skills of exploring ideas, discerning claims, and analyzing arguments (Facione & Facione, 1994). The *evaluation* sub-scale on the CCTST also encompasses a dual meaning. It "means to assess the credibility of statements and the logical strength of inferential relationships and to be able to justify one's reasoning by reference to relevant evidence, concepts, methods, contexts, or standards" (p. 9). The sub-skills of stating results, justifying procedures, and presenting arguments are incorporated in the evaluation sub-scale. *Inference*, the third sub-scale included in the CCTST, is described as the ability to recognise and procure elements needed to extract plausible conclusions; to make predictions and hypotheses, to consider pertinent information and to elicit "the consequences flowing from data, statements principles, evidence, judgements, beliefs, opinions, concepts, descriptions, questions, or other forms of representation" (Facione and Facione, 1994, p. 5).

In addition to the sub-scales of analysis, evaluation, and inference described above and derived from the APA Delphi report, *deductive* and *inductive* reasoning which are considered the more traditional conceptualization of logic can also be calculated from the CCTST as separate sub-scales simply by reclassifying 30 of the 34 items on the test (Facione and Facione, 1994). Deductive reasoning as reflected on the test indicates that "the assumed truth of the information provided necessitates the truth of the inference drawn" (Facione, 1997, p. 10); that is, reasoning from the more general to the specific. Inductive reasoning, which reflects an individual's reasoning from the specific to the general, "means that an argument's conclusion is purportedly warranted, but not necessitated, by the assumed truth of its premises." (p. 10).

California Critical Thinking Disposition Inventory (CCTDI)

The development of the CCTDI (Appendix I) began in 1991 and was first published in 1992 by Facione and Facione. To arrive at the final instrument, "multiple pilot item prompts were written for each phrase of the consensus 1990 APA Delphi description of the ideal critical thinker found on page six of this report. The resulting 250 prompts were screened by college level CT educators to identify possible ambiguities of interpretation. A selection of 150 pilot prompts were retained in a preliminary version of the instrument. "The pilot version was administered to a representative sample of 164 students...at three different comprehensive universities, one in Canada, one in California, and one in the Midwestern United States." (Facione, Facione, & Giancarlo, 1996, p. 3). The instrument, intended to measure a person's dispositions or habits of mind (Facione & Facione, 1992, p. 2), is a Likert scale tool composed of 75 declarative statements. After reading each statement participants respond by choosing one of six options including "disagree strongly" to "agree strongly".

The individuals' responses generate an overall score as well as seven sub-scales scores. These sub-scales include: *truth-seeking, open-mindedness, analyticity, systematicity, critical thinking self-confidence, inquisitiveness, and maturity* (Facione, Facione, & Giancarlo, 1996). The truth-seeking scale measures intellectual honesty, the courageous aspiration to acquire the best knowledge in any situation, the tendency to pose challenging questions, and the willingness to pursue the reasons and evidence regardless of where it leads. Open-mindedness reflects an individual's ability to be accepting of different beliefs and ideas. The analyticity scale appraises alertness to possible difficulties and alertness to problem solving when necessary by using reason and evidence. The tendency to be an organized, focused, diligent and determined individual is reflected in the systematicity scale. The CT self-confidence reveals the level of trust an individual recognises in one's reasoning process and the ability to direct others to arrive at sound decisions. An individual who is intellectually curious, who appreciates being well-informed, and who is disposed to master things even if his or her direct application is not immediately evident reflects inquisitiveness. The maturity scale aims at an individual's

disposition to be reflective in making judgements. This scale deals with "cognitive maturity and epistemic development" (Facione, Facione, & Giancarlo, 1996, p. 3).

Background/Demographic Data Questionnaire

A questionnaire (Appendix J) was developed by this researcher to gather background and demographic data from subjects who took part in the study. Based on the literature review, the questions that were included in the questionnaire requested information about variables that were identified as relevant to the study and to the understanding of students' dispositions and critical thinking skills. These variables were age, gender, language of origin, level of education, year of nursing program, exposure to problem-based learning as a mode of learning, and prior enrollment in courses related to critical thinking.

In addition to the variables discussed above, two additional questions that were part of the inventory and skills test developed by Facione (1990) were added to the background/demographic questionnaire used for the study. Question number 8, "Out of the 34 items on the California Critical Thinking Cognitive Skills Test I am confident I answered ____ of them correctly" was used to ascertain how confident students were about their level of critical thinking as measured by such a test. Question number 9 on the questionnaire solicited the students' attitude toward the importance of critical thinking in deciding what to believe or what to do.

The complete questionnaire was reviewed by several individuals for both structure and content validity. The final version reflected the suggested modifications.

Reliability and Validity of Measures and Measurement Process

Two critical indicators reflective of research quality are reliability and validity of instruments used to collect data (Brink & Wood, 1994; LoBiondo-Wood & Haber, 1998). Reliability and validity issues are a constant challenge for nurse researchers in all phases of the research process particularly when planning to utilize already existing instruments.

Reliability

Generally, *reliability* is concerned with the ability of the instrument to create results that can be reproduced: if the results cannot be reproduced, it is believed that no

truth can be known (LoBiondo-Wood & Haber, 1998; Talbot, 1995). According to Talbot (1995), reliability is a necessary, but not sufficient condition for validity. Three attributes of reliability: stability, equivalence, and consistency (Talbot, 1995 & Traub, 1994) require important considerations. Stability refers to the degree to which the same results occur with repeated use of instruments and is usually reported as test-retest or intra rater reliability. Stability is usually obtained by calculating the reliability coefficient which is a numerical indicator of the instrument's reliability. Equivalence is essential when a study uses either two parallel forms of a test or more than two data collectors. Lastly, internal consistency or homogeneity refers to the degree to which all items and subscales measure the same phenomenon under study. It is usually reported using one of three measures: the Kuder-Richardson (K-20), the Cronbach Coefficient Alpha, or the Split Half or the off-even coefficient corrected by the Spearman-Brown prophecy (Brink & Wood, 1994; Polit & Hungler, 1987; Talbot, 1995).

California Critical Thinking Skills Test. The CCTST, comprises 34 multiple choice questions, and takes a minimum of 45 minutes to administer. The pilot instrument was formulated using a combined set of 200 items aimed at establishing reliability and validity of critical thinking during a 20 year research program (Facione and Facione, 1994). The items selected were accepted based on their ability to reflect the domain of the five critical thinking cognitive skills perceived by the Delphi experts to lie within the critical thinking construct.

The Kuder-Richardson 20 (KR-20) internal consistency reliability measure was .70 to .71 on Forms A and B. In this case the reliability is considered to be at an acceptable level (LoBiondo-Wood & Haber, 1998). Facione and Facione (1994) considered increasing the internal consistency measure by using the Spearman-Brown Prophesy Formula. Based on the calculation using this formula, the instrument would have needed an expansion from 34 to 62 questions in order to increase its internal consistency to .80. Facione and Facione (1994) decided against this increase on the basis that "the complexity of the items on the CCTST creates sufficient mental fatigue" with possible consequences to "decrease the overall reliability estimate of true scores in terms of increasing error due

to fatigue" (p. 9). Based on the aggregate research report compiled by Facione (1997), which included 145 predominantly undergraduate samples (N = 7926 cases) submitted by collaborative investigators from 50 nursing education programs representing all parts of the United States, the KR-20 statistic ranged between .68 and .70. According to Facione (1997), "this is viewed as highly acceptable for an instrument directed at a construct that, by definition, is not unified but contains a number of discernibly distinct elements" (p. 11). The KR-20 reliability calculated for the purpose of this study, based on a sample of 228 baccalaureate nursing students, was .69. This statistic falls within the acceptable ranges reported in previous studies.

California Critical Thinking Skills Disposition Inventory. The CCTDI includes 75 statements along with a 6-point Likert scale agree-disagree response format. It takes a minimum of 15 minutes to administer. Following the initial development of the 75 item CCTDI, the investigators calculated the Cronbach's alpha internal consistency reliability coefficients and the overall instrument alpha reliability. The Cronbach's alpha, the most widely used reliability coefficient, is an "index of the degree to which all of the different items in a scale are measuring the same attribute" (Polit, 1996, p. 249). Based on a sample of 587, the overall Cronbach alpha reliability was .91 and the individual sub-scales Cronbach's alpha were as follows:

Truth-seeking	.71	Systematicity	.74	Inquisitiveness	.80
Open-mindedness	.73	CT-Confidence	.78	Maturity	.75
Analyticity	.72				

(Facione, Facione, & Giancarlo, 1996, p. 5). Subsequently, the alpha levels remained constant (.60 - .78 for the seven sub-scales and .90 overall) when the published version of the inventory was administered to a total sample of 1019 freshman college students in 1992 and 1993 (p.6).

The overall Cronbach alpha reliability for this study was .91 and the individual sub-scales Cronbach's alpha were as follows:

Truth-seeking	.70	Systematicity	.73	Inquisitiveness	.84
Open-mindedness	.64	CT-Confidence	.82	Maturity	.70
Analyticity	.84				

Both the sub-scale and overall alpha coefficients are congruent with those reported by the originators of the CCTDI. These results attest to the internal reliability of the subscales.

Validity

Validity refers to "whether a measurement instrument measures what it is supposed to measure." (LoBiondo-Wood & Haber, 1998, p. 331) in a given sample or population. Three major approaches to validity are most often discussed in the research literature: content validity, construct validity, and criterion-related validity (Brink & Wood, 1994; LoBiondo-Wood & Haber, 1998; Polit, 1996; Talbot, 1995). It is important to recognise that the purpose(s) of the study and the types of data collection instrument utilized governs the researchers' choice of reliability and validity measures (LoBiondo-Wood & Haber, 1998).

Content validity according to Brink and Wood (1994) is a self-evident measure which also entails a comparison between the content of the measurement tool and the available literature on the subject. They suggest that an expert in the field should be able "to judge whether or not the tool adequately samples the known content." (p. 176). Furthermore, Brink and Wood suggest that a panel of experts, cognizant of the content area can be drawn together to judge whether or not a particular instrument adequately represents the known universe of the content being covered. The individual judges' responses would be recorded to ascertain the percentage of agreement among them. (177). *Construct validity* tests strive to verify that an instrument truly measures the concept being studied. Assessing construct validity is a challenge for researchers, especially when considering more abstract concepts, because they must answer such questions as "is the abstract concept under investigation being adequately measured with this instrument" and "what is this measuring devise really measuring?" (Polit & Hungler, 1987, p. 326). *Criterion-related validity* "indicates to what degree the subject's performance on the measurement tool and the actual behavior are related" (LoBiondo-Wood & Haber, 1998, p. 322). Concurrent and predictive validity are two types of this type of validity. Concurrent validity is established based on the correlation between two measures of the same concept administered simultaneously (LoBiondo-Wood & Haber,

1998). For example, an instrument measuring critical thinking is said to have concurrent validity if its score correlates highly with another reliable and valid tool used to measure critical thinking at the same time. Predictive validity is associated with instruments that accurately predict some future incident or event (Brink & Wood, 1998).

California Critical Thinking Skills Test. Content validity of the CCTST rests on its association to the APA Delphi Report Research (Facione & Facione, 1994). The CCTST is also the first instrument to derive construct validity from the National Expert Consensus Statement on Critical Thinking and the Ideal Critical Thinker (1990) (Facione & Facione, 1994; Rane-Szostak & Fisher Robertson, 1996). The comprehensive and thoughtfully articulated descriptions of these two concepts was completed after two years of work by a panel of 46 theoreticians representing several disciplines across Canada and the United States. Facione, Facione, and Sanchez (1994) reported a high and significant correlation ($r = .66$ and $.67$, $p<.001$) between the CCTST and the California Critical Thinking Disposition Inventory (CCTDI) (Facione & Facione, 1992) based on the results of two pilot groups. Concurrent validity of the CCTST with other factors is ongoing. To date, pretest results have been significantly correlated with such factors as college GPA ($r = .20$, $p<.000$), Scholastic Aptitude Test (SAT) Verbal Score ($r = .55$, $p<.000$), and the SAT Math Score ($r = .44$, $p < .000$) (Facione, 1990b, p. 4). The CCTST has also been correlated with the WGCTA, one of the oldest, most widely known and widely used tests to assess critical thinking. First, the correlation between the WGTCA and CCTST ($r = .405$, $p <.001$) was obtained using a sample of 139 students who completed the two tests at program entry. Secondly, based on the scores of 65 students who were members of an existing program, the relationship between the two tests was quite strong ($r = .544$, $p <.001$). No predictive validity evidence of the CCTST is available at this time. Longitudinal cohort studies such as the ones investigating the relationship between critical thinking and clinical judgement are in progress (Facione, 1995; Facione & Facione, 1994).

California Critical Thinking Disposition Inventory. As described earlier in this chapter the CCTDI, (one of the few measurement tools currently available to measure individuals' critical thinking dispositions), was grounded in the definition of the ideal

critical thinker developed by members of the APA Delphi Study. This strong grounding was initially sufficient to support its validity. In 1996 Giancarlo undertook two additional studies to establish the CCTDI's validity. First, using the California Q-sort techniques, Giancarlo further tested the APA (1990) consensus description of the ideal critical thinker. Twenty individuals who are recognized as experts in the area of adult critical thinking were asked to sort 100 Q-sort items with the goal of identifying the ideal critical thinker characteristics. The individual 20 characterizations were amalgamated to construct a model representing the ideal critical thinker. As reported by Facione (1997, p. 12), this new prototype or model correlated with undergraduate students' CCTDI scores ($r = .36$, $N = 91$, $p < .001$). Secondly, Giancarlo investigated the association between the CCTDI and ego-resilience which denotes "psychological flexibility, mental health and adjustment" and "openness to experience" which reveals "engagement with one's environment, curiosity, and diligence." Her findings reflect a positive correlation between CCTDI and ego-resilience ($r = .58$, $N = 198$, $p < .001$) and between CCTDI and openness to experience ($r = .37$, $N = 198$, $p < .001$) (as cited in Facione, 1997, p. 12).

Data Collection Procedures

Following the sample access procedure described in Chapter Three the researcher met each group of potential participants on the designated date and time. At each session, the researcher used a written script (Appendix F) to introduce herself and indicate her status of graduate student. She reviewed the purpose and benefits of the research study. The researcher then proceeded to identify the documents that each student received and the approximate time it would take to complete all the documents. Those who chose not to participate were thanked for considering the proposal and given the opportunity to leave. Those students who chose to remain were asked to proceed based on specific instructions, also detailed in Appendix F. The script and procedures described within were consistently adhered to from group to group.

Data Analysis

Both the CCTST and the CCTDI were computer scored according to the detailed guidelines provided in the CCTST and the CCTDI test manuals accompanying each

instrument. As part of the overall data analysis protocol, the reliability of the CCTST and the CCTDI were established using the Kuder Richardson 20 (KR-20) and the Cronbach Alpha, respectively. These results are reported on page 71of this report. The data generated from the computer scoring phase were then transferred to a SPSS program as data files.

The California Critical Thinking Skills Test (CCTST)

The scoring of the CCTST produced scores for five sub-scales as well as an overall score. The five sub-scales were analysis, evaluation, inference, deductive reasoning, and inductive reasoning. Based on pre-designated choices provided in the test manual, each correct item on the test received one point. The total score was calculated out of 34. The individual sub-scale scores were the sum of the correct items for that sub-scale (Facione & Facione, 1992). Percentile norms provided by Facione (1997) were used as a basis for comparison. Descriptive statistics such as mean, mode, median, standard error, standard deviation, minimum score and maximum score were obtained, and the range of scores were used to summarize the data. Analysis of variance (ANOVA) tests were used to explore differences in means among the four groups of students (Years 1 - 4) for each of the five sub-scales: analysis, evaluation, inference, deduction, and induction and for the overall CCTST scores. The use of ANOVA supposes the following assumptions: 1) the compared groups are constituted by randomly sampled subjects; 2) the dependent variable is normally disbursed in the population of interest; 3) the population of interest has variance considered to be tantamount (Talbot, 1995, p. 157). In this study only assumptions two and three were met. The sample was one of convenience thus the four groups within the sample were not randomly sampled.

The California Critical Thinking Disposition Inventory (CCTDI)

The CCTDI offered eight scores: the seven scale scores and the overall total score. According to Facione, Facione, and Giancarlo (1996), students who are highly disposed toward critical thinking but who had a weak disposition toward critical thinking, earned 3 points or less for each item. Students who had a strong disposition toward critical thinking earned 5 or 6 points for each item. The points were subsequently converted into

the proper scale scores with a maximum score of 60 on any of the scales. A score higher than 50 on any of the sub-scales reflects a strength in that disposition. A score higher than 40 indicates a positive inclination. Scores between 31 and 39 suggest an ambivalent inclination toward the specific disposition. Scores 30 or lower indicate a negative tendency and scores between 10 and 20 reflect a strong negative inclination. The overall maximum score is 420. An overall score of less than 280 indicates a serious overall deficiency in the disposition toward critical thinking. Scores between 280 and 350 demonstrate a positive score, whereas an overall score of 350 or more reflects a solid indication of across the board strength in a particular disposition (Facione, 1997).

To facilitate scoring, students recorded their answers to the CCTDI on scannable answer sheets. Six choices were permitted for each of the 75 items. Instructions for optical scoring included directions regarding how to register the proper credit for each of the six possible responses. Directions on how to group the items by the proper sub-scales; how to combine the points for each item into the raw scale score; how to standardize each scale score; and how to calculate the overall score were also provided by Facione, Facione, and Giancarlo (1996). Descriptive statistics, included mean, mode, median, standard error, standard deviation, minimum score and maximum score obtained, and the range of scores. ANOVA tests were used to investigate the differences among the four groups of students (Years 1 - 4) for each of the seven sub-scales and for the overall CCTD total scores. The Chi-square test of independence coefficient was used to determine the general relationship between the students' dispositions toward critical thinking and their critical thinking skills. The chi-square test of independence, a nonparametric test, is used to draw inferences about whether a relationship exists between two variables that are cross tabulated employing a contingency table. The chi-square test also assumes that the observations are randomly and independently sampled from the population of interest. Furthermore, each subject must qualify for only one cell of the contingency table. In addition the chi-square demands that the anticipated frequency of each cell be greater than 0; nonetheless, at least 5 is advised particularly when the number of cells are few (Polit, 1995, p. 196). In this study the assumption associated with the sampling was not met.

The sample was one of convenience thus the four groups within the sample were not randomly sampled.

Background/Demographic Data Questionnaire

The background/demographic data provided by each subject was summarized using the most appropriate descriptive statistics, namely, mean, median, standard error, standard deviation, number of categories, and the range of scores. Chi-square analysis determined relationships among the following variables: the students' age; gender; language of origin; level of academic achievement prior to entering the nursing program; years of nursing education completed; participation in the accelerated program; experience with problem-based learning; and previous completion of a college or university level course specifically designed to teach students how to think logically, to improve their reasoning, or to sharpen their critical thinking skills; and the students' skills of critical thinking.

Missing Data

California Critical Thinking Skills Test (CCTST)

Table 1 summarizes the information related to the number of questions left unanswered by participants who completed the CCTST. Thirty-eight (16.66%) participants from the total study sample were not able to complete the 34 item test within the allotted time of 45 minutes. The largest percentage (21.25%) of incomplete tests were among fourth year students; whereas, the smallest percentage (9.43%) of incomplete tests were by second year students. The total number of questions unanswered ranged from 1 to 10; the mean and mode were 5 and 4 questions, respectively. According to the instructions provided by Facione and Facione (1994) in their California Critical Thinking Skills Test (CCTST) manual, non-selection constituted an incorrect response. Consequently a mark of zero was assigned to a question left unanswered.

Table 1. CCTST Missing Data

Year of Program	Number of Participants Who Did Not Complete All 34 Items of CCTST	Related Percentage	Number of Questions Missed - (No. of Participants)
Year 1	7 out of 38	→23.68%	4 - (5) 3 - (1) 2 - (1)
Year 2	5 out of 53	→09.43%	7 - (1) 6 - (2) 5 - (1) 4 - (1)
Year 3	9 out of 57	→15.78%	9 - (2) 7 - (2) 6 - (1) 5 - (1) 4 - (2) 3 - (1)
Year 4	17 out of 80	→21.25%	10 - (1) 9 - (2) 8 - (1) 7 - (1) 6 - (1) 4 - (8) 2 - (4)
Totals	**38 out of 228**	**→16.64%**	**Range - 9 Mean - 5 Mode - 4**

California Critical Thinking Disposition Inventory (CCTDI)

Table 2 below contains the information related to the number of statements not completed by participants who wrote the CCTDI. According to Facione, Facione, and Giancarlo (1996) a CCTDI response should be "handled as missing if the item has not been answered, if the mark is illegible, if it is crossed out, or if more than one response is marked." (p. 11). They also indicate in the CCTDI test manual that if large numbers of statements remain unanswered, the CCTDI becomes an invalid measure of that subject's disposition toward critical thinking. In this study only six members (2.63%) of the sample were unable to respond to all seventy-five items on the inventory. The largest number of items left unanswered by a student was 10. It is interesting to note that fourth year students had the largest percentage of incomplete inventories, whereas, all first year students were able to complete their inventory within the allotted time frame. As recommended by Facione, Facione, and Giancarlo (1996) the missing responses for all six of the participants were handled by scoring the mean raw item for the scale. This requires

"summing points associated with answered items, dividing this sum by the number of answered items, and using this mean for unanswered items" (p. 11-12).

Table 2. CCTDI Missing Data

Year of Program	Number of Students Who did not Complete all 75 Items of CCTDI	Percentage	Number of Statements Missed - (No. of Students)
Year 1	0 out of 38	→0.00%	0
Year 2	1 out of 53	→1.88%	8 - (1)
Year 3	2 out of 57	→3.50%	7 - (1) 1 - (1)
Year 4	3 out of 80	→3.75%	10 - (1) 7 - (2)
Totals	6 out of 228	→2.63%	Range - 9 Mean - 7 Mode - 7

Background/Demographic Data Questionnaire

The data deemed missing in the questionnaires is identified in Table 3 as part of the characteristics of the sample. Most participants (87.3%) who completed the questionnaire did provide all requested information; however, a small percentage left some of the questions posed unanswered. The items dealing with gender, native language, enrollment in accelerated program (applied only to subjects in years 3 and 4), completion of a critical thinking/logic/reasoning course, and experience with problem based learning were completed by all students. Twelve students (4.4%) omitted their ages. Only six students (2.6%) excluded their highest level of education before admission to the nursing program. All of the students responded to the question about completion of a critical thinking/logic/reasoning course; however, one of these students did not indicate the number of years since completion of that course. Out of the 228, participants only one chose not to indicate his/her attitude toward critical thinking and being logical. The item

omitted by the majority of students (12.7%) related to the number of correct responses they predicted they had correctly answered out of the total 34 CCTST multiple choice questions.

Summary

Overall, the majority of participants (83.34%) were able to complete all 34 multiple choice items on the CCTST. Of those participants who responded to less than 34 items, only 5.2% missed 6-10 questions, while the remainder (11.6%) missed less than six questions. The CCTDI was also completed by the majority (97.37%) of the sample. Only the year one participants were able to complete all 75 items on the inventory within the time allotted. Year 4 participants left the greatest number of unanswered questions in both of the instruments. Some of those not able to complete the instruments, particularly the CCTST, revealed that they spent too much time thinking about each individual question and as a result 'ran out of time'. Only a small number background/demographic questions were omitted by 12.7% of the total sample.

CHAPTER 4

Findings and Discussion

The focus of this chapter is on the findings of the study and related discussion. These two areas are combined to enhance consolidation and readability. This chapter has been divided into four main sections:

1) characteristics of the sample;

2) critical thinking skills of baccalaureate nursing students;

3) critical thinking dispositions of baccalaureate nursing students; and

4) the relationship between critical thinking skills and critical thinking dispositions.

The first section includes the characteristics of the sample based on the background/demographic variables: age and gender; native language; enrollment in accelerated program; highest level of academic achievement before admission to the nursing program; completion of a critical thinking/logic/reasoning course; attitude toward critical thinking and being logical; experience with problem-based learning (PBL); and confidence level about the number of correct responses on the CCTST. In addition to the statistical summary, the relationship between each variable and critical thinking is described and discussed. Where possible, the findings of this study are compared to the findings of other studies. It is worth noting that the majority of participants believed that critical thinking and being logical was extremely important (46.1%) or more important than most other things (39%). It is also very interesting to note that the majority of participants (51.3%) overestimated how well they did on the CCTST.

The second and third sections contain the CCTST and CCTDI results for all participants as well as participants in each year of the program. These results are summarized in tables and followed with corresponding narrative. As well, the results of this study are compared to other research studies which used similar levels of students and measurement. Overall the participants did well in the CCTST and CCTDI despite some individual and group variations. The lowest mean score for the CCTST was achieved by year 3 participants. It was surprising to find that there was no statistically significant difference among the four years of the program for the overall scores on the CCTST and

the CCTDI. In the last section of this chapter the significant relationship between critical thinking skills and critical thinking dispositions is presented.

Characteristics of the Sample and their Relationship to Critical Thinking

The number of nursing students who took part in the study has remained stable since the completion of data collection. None of the 228 participants have withdrawn from the study and no cases have been eliminated due to errors in completing any of the required instruments. Table 3 summarizes the characteristics of the study sample based on the information collected in the background/demographic questionnaire. These characteristics are age; gender; native language year of program; enrollment in accelerated program; educational background; highest level of academic achieved before admission to the nursing program; completion of critical thinking/logic/reasoning course; experience with problem-based learning; belief about critical thinking; and confidence in their critical thinking skills and abilities.

Table 3. Characteristics of the Study Sample

Characteristic	Dimension	Sample (n= 228)
Age in years	Minimum-Maximum Mean Mode Missing	18-50 22.6 21.0 10 (4.4%)
Gender	Female Male	89.5% (204) 10.5% (24)
Native Language	English Other	90.4% (206) 9.6% (22)
Enrollment in Accelerated Program (Applies only to Years 3 & 4)	Yes No	2.9% (4) 97.1% (133)

Characteristic	Dimension	Sample (n= 228)
Highest Level of Academic Achievement Before Admission to Nursing Program	Some High School Diploma	2.2% (5)
	High School Diploma	43.9% (100)
	Some College Level Courses	7.5% (17)
	Some University Level Courses	28.5% (65)
	Diploma or Certificate	9.2% (21)
	Baccalaureate Degree	5.7% (13)
	Other	0.4% (1)
	Missing	2.6% (6)
Completion of Critical Thinking/Logic/ Reasoning Course	Yes	27.2% (62)
	No	72.8% (166)
~~	~~~	~~~
Years Since Completion of Course for Yes Respondents	Less than 1 year	29.0% (18)
	One year	48.4% (30)
	Two years	9.7% (6)
	Three years and over	11.3% (7)
	Missing	1.6% (1)
Attitude Toward Critical Thinking and Being Logical	A Waste of time	0.0% (0)
	Helpful, but not nearly as important as lots of other things	14.5% (33)
	More important than most other things	39.0% (89)
	Extremely important	46.1% (105)
	Missing	0.4% (1)
Experience With Problem Based Learning (PBL)	Involved with PBL seminars during each term of each year	15.8% (36)
	Enrolled in specific course(s) using only PBL	7.9% (18)
	Enrolled in some course(s) which have utilized PBL approach	66.2% (151)
	Never experienced PBL	10.1% (23)

Characteristic	Dimension	Sample (n=228)
Confidence Level About the Number of Correct Responses Students Predicted They Had Correctly Answered out of 34 on the CCTST	Minimum-Maximum	0-34
	Mean	19.52
	Mode	20.00
	Median	20.10
	Underestimated	31.5% (72)
	Overestimated	51.3% (117)
	No Estimate/Missing	12.7% (29)
	Correctly Estimated	4.4% (10)

Age

All participants were asked how old they were (rounded off to the nearest year) on January 1, 1997. The overall mean age for the participants was 22.6 years, slightly lower than the overall mean of the total population (24.34 years). Of the 38 year-one participants who took part in the study, thirty-five provided their ages. The youngest participants in year 1 were 18 years of age, and the oldest participant was 33 years of age creating an age range of fifteen years. The most frequent age was 18. The average age was 20.31 years, with a standard deviation of 2.83 years. Fifty (94.33%) of the fifty-three second year participants reported their age on the background/demographic questionnaire. The age range was 21 years: the youngest participant was 18 years old and the oldest participant in the group was 39 years of age. Most of the participants in the second year group reported an age of 20 years; the mean age for this group was of 21.86 and the standard deviation was 4.23 years. Fifty-seven third-year students participated in the study; 53 (92.98%) reported ages. The youngest of these participants was 20 years old and the oldest participant was 39 years old, creating a range of 19 years. Twenty-one years was the most frequent age reported. The mean age for this group was 23.83 years of age, with a standard deviation of 4.85 years. All eighty participants in the year 4 sample gave their age. The age spread was between 20 and 50 years with a range of 30 years. The mode for this group was 21 years, and the mean was 26.71 years with a standard deviation of 6.82 years.

In this study, age of participants was not significantly related to critical thinking skills scores ($\chi^2 = .637$, $p = 0.43$, power $< .80$). This result coincides with the majority of other studies (Gross, et al, 1987; Waite, 1989; Lynch, 1988; Brooks & Shepherd, 1992; Facione, 1997) discussed in the literature review which also found no significant correlation or a negative correlation between age and critical thinking scores.

Thus the lack of relationship between age and critical thinking contradicts the assumption or belief held by some authors that individuals become better critical thinkers as they grow older. The rationale of authors such as Alfaro-LeFevre (1995), who posited that experience as well maturity does grow with chronological age may account for some variance in the levels of critical thinking. It can be concluded that age does not play a major role in the development of critical thinking.

Gender

The majority of the participants (89.5%) were female compared to 10.5 % who were male. These percentages are similar to those of the total population of students in the program at the time of data collection (Females - 90.8% and Males - 9.2%). Table 4 contains the CCTST and CCTDI statistics for the small group (N = 24) of male participants within the larger sample of participants. As evident from the figures, the overall mean scores of males for the skills test and disposition inventory are higher than those of the complete sample of participants (CCTST = 17.43 & CCTDI = 312.20) Nonetheless no statistically significant relationship was found between gender and critical thinking skills ($\chi^2 = 4.5$, $p = .20$, power $< .80$). The low power should caution the reader in drawing a definitive conclusion about these results; however, they are congruent with other findings reported in the literature (Facione, 1997; Waite, 1989).

Table 4. CCTST and CCTDI Statistics for Male Participants

	CCTST			CCTDI		
	Mean	SD	Min-Max	Mean	SD	Min-Max
Year 1 (4)	19.50	8.81	9-30	304.0	34.17	266-346
Year 2 (4)	19.25	3.20	17-24	312.5	13.94	294-326
Year 3 (8)	19.00	4.59	11-20	318.8	21.47	275-349
Year 4 (8)	18.00	3.50	12-23	336.1	41.35	278-379
Total Group (24)	**18.79**	**4.58**	**9-30**	**321.0**	**32.82**	**266-379**

Native Language

The variable of native language is not widely explored in relation to critical thinking; however, the researcher was interested in investigating such a variable because it has been her experience as a nurse, educator, and administrator that command of the English language influences an individuals' ability to express himself or herself both verbally and in writing. As well it influences their aptitude to comprehend written material. Only 9.6% of the participants indicated that their native language was other than English. No data was available regarding this characteristic for the total population of students enrolled in all four years of the program at the time the study was conducted. The analysis indicates that there was a significant relationship ($\chi^2 = 12.4$, $p = 0.042$, power >.80) between language of origin and critical thinking skills as measured by the CCTST instrument.

Unfortunately there are no studies which have correlated this particular variable to either critical thinking skills or dispositions of nursing students. In her aggregate report, Facione (1997) indicates that the variable of native language was unavailable and therefore could not be used as part of the correlational matrix.

Year of Program

All years of the program were represented in the total group of 228 participants for this study. The largest percentage of participants were enrolled in the fourth year of the program (35%); the smallest percentage of participants were enrolled in first year of the program (16.6%). The relationships concerning year of program and CCTST and CCTDI will be discussed later in this chapter.

Enrollment in Accelerated Program

Only the Year 3 and Year 4 participants (137) who took part in the study were eligible to be enrolled in an accelerated program and therefore were able to respond to this question on the background/demographic questionnaire. Of the 137 participants, the majority (97.1%) were not enrolled in the accelerated program. At the time of data collection 39 students were members of the accelerated group; therefore, the four students who were part of the accelerated group and who also chose to take part in this study represent a small percentage of the total accelerated group (10.25%). The four participants who indicated enrollment in the accelerated program obtained the following scores on the CCTST and CCTDI (Table 5):

Table 5. CCTST and CCTDI Scores of Accelerated Participants

Participants	CCTST Score	CCTDI Score
1	18	325
2	24	339
3	15	337
4	15	215
Means	18	304

The sample of accelerated students was too small to be used to draw inferences regarding a relationship between enrollment in the accelerated program and critical thinking scores. The four participants' mean critical thinking scores were comparable to

those of all participants; however, it should be noted that the four scores in this small sample have a range of 9 and the mean is affected by the high score of 24. The four participants' mean score of 304 on the CCTDI was lower than that of all participants (312.30); nonetheless, three out of the four accelerated participants had scores between 280 and 350, demonstrating a positive inclination.

Highest Level of Academic Achievement

A summary of the highest level of academic achievement before admission to the nursing program is reported in Table 3 (p. 83). Most of the participants (43.9%) had a high school diploma or equivalent. Among these participants the greatest percentage (50.96%) were part of the fourth year sample and the lowest percentage (31.6%) were year one participants. The next highest level of academic achievement reported by participants (28.5%) was 'some university courses'. Of the 65 participants included in this category, the majority (39.5%) were part of the first year group; only 16.9% of the fourth year group reported completion of some university level courses. Those participants (N = 33) who indicated achievement of a diploma or certificate, baccalaureate degree or other were requested to provide specifics. Their responses are summarized in the following table.

Table 6. Types of Diplomas/Certificates and Baccalaureate Degrees: Years 1 - 4

	Diploma/Certificate	Baccalaureate Degree	Other
Year 1	Bible School/Travel and Tourism	Bachelor of Science BSc - Honors Genetics BSc -Kinesiology Business	Three years of university
Year 2	Landscape Architectural Technology Land Agent/RPN	BA - Chinese/Classics Bachelor of Science X 2 Bachelor of Physical Edu.	

	Diploma/Certificate	Baccalaureate Degree	Other
Year 3	Business Management Christian Studies Hairstyling	Bachelor of Arts X 2 Bachelor of Arts - Christian Education & Missions	
Year 4	Secretarial X 4 LPN X 5 RNA Dressmaking Legal Assistant/Para-legal Medical Receptionist Air Traffic Control Christian Studies	MD - Radiology Major BSc - Biology: Nutrition & Chemistry	

It is interesting to note the variation in diplomas and certificates reported by participants. Secretarial and Licensed Practical Nurse (LPN) were indicated most frequently by fourth year participants. A Bachelor of Science was the most frequently reported degree. First year participants reported having the most baccalaureate degrees whereas the majority of participants from year four who answered this question affirmatively reported completion of diploma or certificate programs.

The level of academic achievement prior to admission to the nursing program was not significantly related to critical thinking scores ($\chi^2 = 8.8$, $p = .19$, power $<.80$). The findings of this study bear some similarities to the findings reported by Wu and Connolly (1992) in their study outlining the profile of non-nurse college graduates enrolled in accelerated baccalaureate nursing programs. They reported that the educational background of their sample [N = 166 (71% of population)] had studied primarily in the humanities and social sciences programs. In their study there was no statistically significant relationship between highest level of academic achievement and overall critical thinking skills ($\alpha = .05$, $\chi^2 = 5.5$, $p = 0.14$, power <0.80). Readers must be cautioned by the power levels in both of these studies. If this variable is of interest to other researchers, it is recommended that adequate power be calculated prior to data collection so that inferences can be based on stronger evidence.

Completion of Critical Thinking/Logic/Reasoning Course

As part of the baccalaureate curriculum nursing students are required to complete a number of elective courses. Some nursing students enroll in courses other than nursing which focus on critical thinking, logic or reasoning. As part of this study participants were asked to indicate if they had completed such a course. Participants who enrolled in a course dealing with critical thinking, logic or reasoning (27.2%) were in the minority; the majority of participants had not enrolled in such a course at the time that they completed the questionnaire. Of those who had completed a course, the majority had done so one year ago (48.9%) or less than a year ago (29.0%). The greatest percentage of participants who had completed a course focusing on critical thinking, logic or reasoning were from the third year group (38.6%). The two groups, those who had and had not completed such a course, were almost identical in their critical thinking score means and ranges of scores. The group who completed a critical thinking, logic or reasoning course had critical thinking scores ranging from 7 to 30, with a mean of 17.31 (SD = 3.92). The group who did not complete such a course achieved a mean of 17.40 (SD = 3.88), with a range of scores between 8 and 29. In addition, the proportion of participants who scored lowest on the CCTST was very similar to the proportion of participants who scored higher on the same test when accounting for the completion of a course specifically designed to enhance critical thinking. A much larger sample size would have been needed to detect significant differences. Nevertheless, based on the statistical analysis, there was no significant relationship between the two groups' critical thinking scores ($\chi^2 = .153$, $p = .49$, power $< .80$).

These results are dissimilar to those of other studies interested in the relationship between completion of a critical thinking course and critical thinking scores. Isaacs (1990) completed a study using a quasi-experimental pretest-post-test design. Groups of beginning nursing students were randomly assigned to the treatment or comparison groups. The treatment group were given a course specifically created to foster the skills of critical thinking while the comparison group received the usual course (primarily lecture and group discussion). Based on the critical thinking scores, as measured by the Cornell

Critical Thinking Level Z test, Isaacs reported a significant difference between the experimental and control group.

In her aggregate report, Facione (1997) provides results from two different sources that support Isaacs' findings but contradict the current study outcomes. First, Facione refers to a 1988-89 validation study for the CCTST. An investigation was carried out to ascertain whether or not the completion of a required semester-long course in critical thinking would impact the critical thinking scores of students. The research encompassed both cross-sectional and matched pairs pretest-posttest designs. Control groups comprised those students who did not take the critical thinking course. In both cases the experimental groups showed statistically significant gains in critical thinking scores ($t = 2.44$, one-tailed $p < .008$; $t = 6.60$, $df = 231$, $p < .001$). Both control groups showed no gains (p. 26). Secondly, the data analysis completed for the aggregate report indicated that the critical thinking mean exit score for participants who completed a designated critical thinking course, whether in nursing or another discipline, was one full point higher ($x = 17.27$, $SD = 4.11$) than the mean exit score achieved by those participants who did not complete such a course ($x = 16.22$, $SD = 3.89$). These differences were statistically significant.

Beliefs About Critical Thinking

The majority of participants who completed this item on the background and demographic data questionnaire believed that critical thinking and being logical were extremely important (46.1%) or more important than most other things (39.0%). Only a small percentage (14.5%) declared that critical thinking and being logical were helpful, but not nearly as important as lots of other things. The researcher was reassured to find out that none of the participants viewed critical thinking as a waste of time. Table 7 is a summary of the beliefs indicated by the participants according to program year. Although there was no significant difference among participants enrolled in different years of the program and their attitude toward critical thinking and being logical (Kendall's Tau, NS), a slightly higher percentage of fourth year students, compared to first, second, and third year students, believed that critical thinking and being logical was extremely important.

Table 7. Attitude Toward Critical Thinking and Being Logical by Years 1 - 4

Attitude	Year 1	Year 2	Year 3	Year 4	Total Group
Helpful, but not nearly as important as lots of other things	10 26.3%	5 9.4%	6 10.5%	12 15.2%	33 14.5%
More important than most other things	14 36.8%	24 45.3%	23 40.4%	28 35.4%	89 39.2%
Extremely important	38 36.8%	24 45.3%	28 49.1%	39 49.4%	105 46.3%
Years Total	**38** **16.7%**	**53** **23.3%**	**57** **25.1%**	**79** **34.8%**	**227** **100%**

Experience with Problem-based Learning (PBL)

Of the 228 subjects who took part in this study the majority (89.95%) reported some experience with PBL. Most of the subjects (151 or 73.7%) reported the experience was gained in some course(s) which utilized a PBL approach. Other subjects were either involved with the approach on a consistent basis (36 or 17.6%); that is, during each term of each year or in specific course(s) which utilized only PBL (18 or 8.8%). Chi-square analysis indicated that the relationship between the participants' experience with problem based learning and their critical thinking skills scores was insignificant ($\chi^2 = .07$, $p = 0 .786$, power $>.80$). An extensive review of the literature on problem based learning, including those in nursing and other health care related disciplines such as rehabilitation medicine, occupational therapy, physical therapy, and respiratory therapy, uncovered several theoretical and experiential based publications but very few research studies. Because of the types of research studies this writer is not able to cite any study that supports or refutes the results reported for the current study.

Confidence in Critical Thinking Skills Abilities

To ascertain how confident they were, participants were asked to predict the number of critical thinking skills questions they thought they had answered correctly. Table 8 contains the numbers and related percentages of subjects who underestimated, overestimated, correctly estimated, or provided no estimate of the number of correct CTST items. Table 9 includes the predicted number of correct CTST items by the participants from each year of the program, as well as the total group. Most of the participants (87.2%) responded to the question. More than half of them (51.3%) overestimated how many questions they answered correctly on the test, whereas 31.5% underestimated the total number of items they answered correctly. The highest percentage of missing/no estimate (12.7%) responses were given by fourth year participants, while the lowest number of missing/no estimate (8.8%) responses were given by third year participants.

Table 8. Predicted Number of Correct CTST Items by Years 1- 4

Years (Number of Subjects)	Underestimated	Overestimated	Correctly Estimated	Missing/ No Estimate
Year 1 (38)	21.5% (8)	57.9% (22)	5.3% (2)	15.8% (6)
Year 2 (53)	39.6% (21)	41.5% (22)	7.5% (4)	11.3% (6)
Year 3 (57)	31.6% (18)	57.9% (33)	1.8% (1)	8.8% (5)
Year 4 (80)	31.3% (25)	50.0% (40)	3.8% (3)	15.0% (12)
Total Group (228)	**31.5% (72)**	**51.3% (117)**	**4.4% (10)**	**12.7% (29)**

The descriptive statistics derived from participants' predictions about the number of correct CCTST items they achieved are described in Table 9. Some of the participants from the Year 1 and Year 3 groups actually predicted that they would achieve zero out of a maximum of 34 points on the test. Some fourth year participants predicted their score

would be as low as two. Although some low predictions might be expected from year one participants, the low responses by third and fourth year participants are somewhat surprising and alarming.

Table 9. Descriptive Statistics Regarding Predicted Numbers of Correct CTST Items by Years 1- 4

	Mean Predictions	Standard Deviation	Median	Mode	Min-Max	Range
Year 1 (38)	19.84	7.1	21.5	25.0	0-30	30
Year 2 (53)	20.04	6.4	19.6	20.0	9-34	25
Year 3 (57)	17.48	7.9	18.4	17.0	0-30	30
Year 4 (80)	20.58	7.1	20.8	20.0	2-34	32
Totals N = 228	**19.53**	**7.2**	**20.1**	**20.0**	**0-34**	**34**

When each of the year means were compared to the means actually achieved by the participants (see below), the predicted means were all higher. It is noteworthy that with the exception of year 3, all participating years predicted well over two full questions higher than they actually achieved. The participants composing the third year sample were the most realistic about their scores; their mean prediction and actual mean score differed by less than one question.

Year	Mean predictions	Actual achieved means	Difference
1	19.84	17.07	2.77
2	20.04	17.71	2.33
3	17.48	16.70	0.78
4	20.58	17.93	2.66
All years	**19.53**	**17.43**	**2.10**

No other sources of data which studied a similar variable exist for the purpose of comparisons. These results indicate that the majority of participants are confident in their ability to critically think on a challenging instrument such as the CCTST. Nonetheless, these results point to a number of questions and concerns. First, assuming that these

results accurately reflect the confidence of the participants and given that the majority of participants are overconfident in how well they can think critically, are they overconfident in their clinical practice? That is, are students more prone to overestimate their ability to critically think when faced with serious situations or decisions of a sensitive nature in clinical practice? Secondly, this researcher expected that participants at the end of a nursing program would be significantly more confident in their ability to think critically, yet the results, based on the ANOVA statistical analysis, indicate that there was no statistically significant difference ($F = 2.005$, $df = 3$, $p = 0.115$) among participants in years 1 - 4. Furthermore, fourth year participants were most likely to not provide an estimate.

Critical Thinking Skills of Baccalaureate Nursing Students

One of the primary questions of interest guiding this study was "What are the critical thinking skills of baccalaureate nursing students in Years 1, 2, 3, and 4?". This section of the report attempts to answer the above question by describing the critical thinking skills of the participants and how they compared to participants in other nursing research studies which used similar instruments and levels of nursing students. The frequency statistics for the total group are presented first followed by the frequency statistics for each of the years. In addition the frequency statistics for each critical thinking sub-scales - analysis, evaluation, inference, deduction and induction are reported and discussed for all study participants.

Critical thinking skills test frequency statistics for all participants. The descriptive statistics for all participants based on the results of the 34 item multiple choice critical thinking skills test are found in Table 10. The mean scores for the four years of the program ranged from 16.70 to 17.94. With the exception of the mean score of 16.70 achieved by the year three participants, all other mean scores increased based on the year of the program. That is, the mean score for year four participants is higher than that of year three participants by 1.23, and the mean score of year two participants is higher than that of year one participants by .64. However, based on ANOVA ($F=1.243$, $df = 3$, $p = 0.295$) there was no statistically significant difference among the four groups of

participants. It is important to note that entry level critical thinking skills were not measured for any of these participants; therefore, it is not possible to know whether the scores for these groups increased, decreased or remained the same over the period of time that they were in the program. Contrary to these findings, Colucciello (1997) found a statistically significant difference ($F = 6.63$, $p = \leq .05$) in critical thinking skills among the different academic levels. Similarly to this researcher's findings, the mean CCTST scores for each academic level in Colucciello's study did not increase accordingly. She attributes the high mean score of the junior group to their high admission GPA.

The lack of a statistically significant difference among the four groups of participants in this study may be associated in part with the cognitive development of the participants. It is believed that cognitive growth/development is associated with the ability to engage in critical thinking (McGovern & Valiga, 1997). The cognitive development of nursing students has been studied by some authors (McGovern & Valiga, 1997; Valiga, 1983) using Perry's (1970) scheme of cognitive/intellectual development. Four major categories comprise Perry's scheme: dualism, multiplicity, relativism and commitment. Based on extensive research using his schemes, researchers have found that cognitive development is influenced by educational experience. The findings of both McGovern and Valiga (1997) and Valiga (1983) indicate that although there was growth in the participants' cognitive development over the extent of their educational experience, most students remained at the lower stages of development - dualistic or multiplistic. These findings suggest that cognitive development requires a much longer period of time than the four years of a baccalaureate nursing program. In addition other factors such as instruction, types of experiences, the amount of direction afforded to students and the manner in which nurse educators and the learning environment convey openness, mutual trust and respect are also crucial in the cognitive development of nursing students and their development of critical thinking skills (McGovern & Valiga, 1997).

In the current study, the overall mean based on the scores of all 228 participants was 17.43 with a standard deviation of 4.01, indicating that all scores fell well within three standard deviations from the mean. The overall mean is higher than that achieved by the

328 students (x = 16.51, SD = 3.96) in Colucciello's study (1997, p. 241) a[illegible]he 633 MSN students (x = 17.3, SD = 4.81) included in the aggregate report by Facione (1997, p. 23). The highest mean (17.94) on the CCTST was achieved by the fourth year group. Again this mean score is higher than that achieved by the senior students in Colucciello's study (x = 17.26, SD unavailable) and the 16.4 score (SD = 3.55) of the 2611 senior students in Facione's (1997) report. Based on CCTST percentile norms provided by Facione (p. 81), the senior students fall in the 60th percentile.

In this study the lowest mean score (x = 16.72, SD = 4.27) among the participants from the program was achieved by the third year cohort. However, as a group they were slightly more homogenous, evidenced by the smaller range (16) in scores compared to the other three groups of participants. As well, when contrasted to the scores of a similar group in Facione's report, the participants in this study had a slightly higher mean score (+.59). They were within the 50-60th percentile (Facione, 1997, p. 81). Comparisons made with a parallel group in the Colucciello's (1997) study produced similar results. The students in Colucciello's study achieved a mean score of 15.61, at least one full question less than the mean score of the participants in this study.

CCTST norms for undergraduate nursing students suggest scores less than 10 or greater than 20 are rare. In this study a very small percentage (2.6%) of the participants achieved scores less than 10; however, a larger percentage (22.8%) of the participants achieved scores above 20. Scores less than 10 were achieved by 5.3% (2) of first year participants, 5.3% (3) of third year participants, and 1.3% (1) of fourth year participants. None of the year two participants achieved scores less than 10. Scores above 20 were achieved by participants as follows: year 1 - 15.8% (6), year 2 - 22.6% (12), year 3 - 24.6% (14), and year 4 - 25.0% (20). Of the participants who scored higher than 20, only one achieved a score of 30. This participant was a male in year one who had completed a science degree prior to entering nursing.

Table 10. Critical Thinking Skills Test Frequency Statistics for Years 1 - 4 Participants

	Mean	Standard Deviation	Median	Mode	Min - Max	Range
Year 1 N = 38	17.08	4.50	17.00	18.00	9 - 30	21
Year 2 N = 53	17.71	3.80	17.78	18.00	10 - 29	19
Year 3 N = 57	16.72	4.27	16.20	14.00	8 - 24	16
Year 4 N = 80	17.94	3.69	17.65	17.00	7 - 27	20
Total N = 228	**17.43**	**4.01**	**17.43**	**17.00**	**7 - 30**	**23**

Overall CCTST and sub-scales statistics for year 1 participants. Table 11 contains the year 1 participants' overall CCTST and sub-scale statistics. This group achieved their best results on the inference sub-scale (among the three Delphi conceptualizations) and their poorest results on the evaluation sub-scale. Between the traditional categories of deduction and induction, this group achieved a higher score on deduction. All of these participants were able to correctly answer a minimum of 2 to 3 questions on each of the sub-scales. Some participants were able to correctly answer the majority of questions associated with the five sub-scales. In fact on the evaluation sub-scale one participant achieved the maximum score of 14; other individuals obtained between 10 and 13. On the traditional sub-scale of deduction some participants (N=8) only missed 1 to 4 items. The analysis sub-scale had the smallest range of 5. This finding coupled with the mean score and associated standard deviation indicates that the members of this group are most similar in this ability. Conversely, the largest range (12) was associated with evaluation. Based on this outcome and the large standard deviation, one can infer that this group varied most in their ability to evaluate. In fact, as indicated above, evaluation proved to be their poorest score.

Based on the CCTST percentile norms provided by Facione (1997) for this level of student, year 1 mean scores were between the 70 and 80th percentile on the overall CCTST score and the sub-scales, with the exception of analysis. The analysis mean score was closer to the 60th percentile. With the exception of the analysis sub-scale score, these results are similar to the results in Colucciello's (1997) study. However, these scores, exclusive of the analysis sub-scale, are all higher than those reported by Facione (1997) for a similar level of participants (N=1245-1281).

Table 11. Year 1 Overall CCTST and Sub-scaled Statistics

N = 38	Mean	Standard Deviation	Median	Mode	Min - Max	Range
CCTST (34)	17.08	4.50	17.00	18.00	9 - 30	21
Analysis (9)	4.45	1.39	4.47	5.00	2 - 7	5
Evaluation (14)	6.53	2.53	6.18	6.00	2 - 14	12
Inference (11)	6.11	1.64	6.43	7.00	3 - 9	6
Deduction (16)	8.37	3.01	8.10	6.00	3 - 15	12
Induction (14)	7.18	1.96	7.25	8.00	2 - 12	10

( ) Indicates maximum score achievable.

Overall CCTST and sub-scales statistics for year 2 participants. The year 2 participants' overall CCTST and sub-scale statistics are displayed in Table 12. Year 2 participants did best on the inference sub-scale and poorest on the evaluation sub-scale, and scored highest on the deduction category. All group members answered at least 3 questions correctly on each of the sub-scales and in some cases, scored close to the maximum achievable. The only exception was the analysis sub-scale: one individual answered only one question correctly out of the possible 9. However, it should be noted that several participants achieved a score of 7 or 8. As noted in Table 12 although the smallest range (7) is reported for the analysis and inference sub-scales, the participants were most diverse on their ability to make inferences ($x = 6.28$, $SD = 1.79$).

Based on the CCTST percentile norms summarized by Facione (1997) for this level of student, Year 2 students' mean and sub-scales scores were within the 70th percentile. These results are higher across the board than the results reported by Colucciello (1997) in her study, as well as those reported for a similar level of participants (N = 1030-1618) by Facione (1997, p. 20).

Table 12. Year 2 Overall CCTST and Sub-scales Statistics

N = 53	Mean	Standard Deviation	Median	Mode	Min - Max	Range
CCTST (34)	17.72	3.80	17.78	18.00	10 - 29	19
Analysis (9)	4.91	1.39	4.92	4.00	1 - 8	7
Evaluation (14)	6.53	2.33	6.25	4.00	3 - 12	9
Inference (11)	6.28	1.79	6.25	5.00	3 - 10	7
Deduction (16)	8.89	2.29	8.59	8.00	3 - 15	12
Induction (14)	7.11	2.09	7.20	7.00	3 - 11	8

( ) Indicates maximum score achievable.

Overall CCTST and sub-scales statistics for year 3 participants. The year 3 participants' overall CCTST and sub-scale statistics are identified in Table 13. Unlike the other three groups in this study, year 3 participants did best on the analysis sub-scale. Similar to the other groups, they achieved the poorest mean score on the evaluation sub-scale. Dissimilar to the other three groups, this group scored higher on the traditional category of induction than they did on the category of deduction. These participants were quite varied in the number of questions they answered correctly on each of the sub-scale. One participant achieved a score of zero on the sub-scales of evaluation and induction. Upon further examination, however, it was discovered that this individual was only able to complete 25 out of 34 items. As a result, she only had the opportunity to answer 5 evaluation related questions out of 14 and 8 induction related questions out of 14. Although the inference sub-scale had the smallest range of score at 6 among the three

Delphi conceptualizations, the participants' level of skill was most similar for the sub-scale of evaluation (x = 5.73, SD = 2.43).

Based on the CCTST percentile norms put forward by Facione (1997) for this level of student, the year 3 students' mean scores were between the 50 and 60th percentile on the overall CCTST score and the sub-scales. Although the participants in this study scored higher on the analysis, evaluation, and inductive sub-scales scores than the participants in Colucciello's (1997) study, these participants scored lower on the overall CCTST and the inference and deduction sub-scales However, all the following scores are higher than those reported for a group of senior nursing students in Facione's aggregate report (N=1725-2611).

Table 13. Year 3 Overall CCTST and Sub-scales Statistics

N = 57	Mean	Standard Deviation	Median	Mode	Min - Max	Range
CCTST (34)	16.70	4.27	16.20	14.00	8 - 24	16
Analysis (9)	4.96	1.59	4.90	5.00	1 - 8	7
Evaluation (14)	5.73	2.43	5.95	5.00	0 - 10	10
Inference (11)	6.00	1.57	5.68	5.00	3 - 9	6
Deduction (16)	7.79	2.41	7.76	7.00	4 - 12	8
Induction (14)	7.19	2.35	7.29	7.00	0 - 12	12

() Indicates maximum score achievable.

Overall CCTST and sub-scales statistics for year 4 participants. Table 14 contains the year 4 participants' overall CCTST and sub-scale statistics. Among the three Delphi conceptualizations, year 4 participants did best on the inference sub-scale and poorest on the evaluation sub-scale. Between the traditional categories of deduction and induction this group achieved a higher score on deduction. It must be noted that despite the fact that the participants' range of scores was widest on the evaluation sub-scale, when one considers the mean score and associated standard deviation, their ability on this sub-scale

appears to be more similar. Also, based on the mean, SD, and range of scores for induction, it is safe to infer that the four year sample was more similar on the induction sub-scale than on deduction. Based on the CCTST percentile norms reported by Facione (1997) for this level of student, year 4 students' overall CCTST mean score was closest to the 70th percentile. The analysis sub-scale score was at the 50th percentile and the deductive sub-scale was at the 90th percentile, with the remainder of the sub-scale scores falling between the 60th and 70th percentile. With the exception of the analysis sub-scale score mean, which was similar to that reported by Colucciello (1997), the overall CCTST mean score as well as the mean score for the other sub-scales were all highest for the participants of this study. As well, all the following scores are higher than those reported for a group of senior nursing students in Facione's (1997) aggregate report (N = 1725-2611).

Table 14. Year 4 Overall CCTST and Sub-scales Statistics

N = 80	Mean	Standard Deviation	Median	Mode	Min -Max	Range
CCTST (34)	17.94	3.69	17.65	17.00	7 - 27	20
Analysis (9)	4.97	1.32	5.00	5.00	2 - 8	6
Evaluation (14)	6.39	2.17	6.30	7.00	1 - 13	12
Inference (11)	6.58	1.64	6.73	7.00	2 - 10	8
Deduction (16)	8.99	2.48	8.89	8.00	2 - 14	12
Induction (14)	7.21	2.12	7.43	8.00	2 - 12	10

( ) Indicates maximum score achievable.

Analysis sub-scale frequency statistics for all participants. Table 15 includes the descriptive statistics for Years 1- 4 participants based on the scores for the analysis sub-scale. The highest score on this sub-scale was achieved by year four participants; however, the difference was minimal when compared to the mean scores of year two and three participants, and 0.42 points higher than the mean score of Year 1 students.

Although some participants obtained very low scores on this sub-scales (as evident in table 15), these mean scores do reflect that each of the groups correctly answer at least 50% of the questions.

The overall mean score for the analysis sub-scale is 4.87, slightly higher than the total mean score reported by Colucciello (1997) ($x = 4.73$, $SD = 1.51$). The mean scores for participants in the four years of the program ranged from 4.45 to 4.97. Although the mean scores for this sub-scale increased slightly with each subsequent year of the program, ANOVA shows no statistically significant difference ($F = 1.396$, $df = 3$, $p = .255$) among the four groups. These findings are congruent with those reported by Colucciello (p. 241) and higher than those summarized by Facione (1997, pp. 19-21), based on a total N= 4148.

Considering that analysis involves a variety of cognitive skills such as: examination, categorization, identification of the elements of arguments, differentiation among empirical, conceptual, and evaluative questions (Dexter, et al, 1997, p. 164), the participants in this study did well in this area. The question that remains for this writer is: 'Should year four participants be expected to do better?'

Table 15. Analysis Sub-scale for Years 1-4 (Maximum Marks Available - 9)

	Mean	Standard Deviation	Median	Mode	Min - Max	Range
Year 1 N = 38	4.45	1.39	4.47	5.00	2 - 7	5
Year 2 N = 53	4.91	1.39	4.92	4.00	1 - 8	7
Year 3 N = 57	4.96	1.59	4.90	5.00	1 - 8	7
Year 4 N = 80	4.97	1.32	5.00	5.00	2 - 8	6
Total N = 228	**4.87**	**1.42**	**4.86**	**5.00**	**1 - 8**	7

Evaluation sub-scale frequency statistics for all participants. The descriptive statistics for Years 1- 4 participants' responses based on the scores for the evaluation sub-scale are summarized in Table 16. All four groups achieved their lowest score on this sub-scale. This finding suggests that the participants were weak in their ability to assess aspects such as the reliability of information sources; the strength of evidence available; the suitability, significance, and utility of information; and the presence of biased and stereotypical language (Dexter, et al, 1997).

The overall mean score for this sub-scale of 6.28 is higher then the total mean score reported by Colucciello (1997) (5.73, SD=2.23). The mean scores for participants in the four years of the program ranged from a low of 5.74 achieved by year three participants to a high of 6.53 attained by both year one and year two participants. The ANOVA statistical analysis indicates no statistically significant difference ($F = 1.426$, $df = 3$, $p = 0.236$) among the groups. These findings are somewhat similar to those reported by Colucciello (p. 241). She found that only one group was significantly different from the others on the evaluation sub-scale.

This preliminary analysis was surprising considering the fact that students are expected to have knowledge of the nursing process and apply these skills in a variety of written assignments, documents, self-evaluations and practice situations throughout their program. Upon further examination, a plausible explanation for these results can be attributed in part to the inability of some participants to complete the CCTST. Those individuals (N=38) who were not able to complete the test (Table 1, CCTST Missing Data, p. 78) were forced to omit the last 1 to 7 items on the test, categorized as evaluation under the Delphi conceptualization and induction under the traditional category (Facione & Facione, 1992, p. 11). Another plausible explanation might be that, despite the variety of opportunities available for students to develop in this area, students experience difficulty in accomplishing the activities associated with the skill of evaluation. Also, it may be possible that without consistent follow-up poor evaluative skills may persist. It would be interesting to pursue this area further because evaluative skills that are either poorly developed or lacking may negatively affect the quality and comprehensiveness of

patient care. The nursing process, which is used as a problem-solving approach by nurses, encompasses several steps. One of these steps is evaluation. Evaluation is a continuous process and a critical phase of the nursing process for at least three reasons. First, evaluation involves the use of judgement about the patient's progress in meeting his or her goals. Secondly, evaluation involves appraisal of the effectiveness of nursing interventions in facilitating the patient's goal achievement. Lastly, the outcome of the evaluation phase provides the nurse and patient with direction regarding what needs to be continued, changed or added to the plan of care.

Table 16. Evaluation Sub-scale for Years 1-4 (Maximum Marks Available - 14)

	Mean	Standard Deviation	Median	Mode	Min - Max	Range
Year 1 N = 38	6.53	2.53	6.18	6.00	2 - 14	12
Year 2 N = 53	6.53	2.33	6.25	4.00	3 - 12	9
Year 3 N = 57	5.74	2.43	5.95	5.00	0 - 10	10
Year 4 N = 80	6.39	2.17	6.30	7.00	1 - 13	12
Total N = 228	**6.28**	**2.34**	**6.12**	**6.00**	**0 - 14**	**14**

Inference sub-scale frequency statistics for all participants. The descriptive statistics for Years 1- 4 participants' responses based on the scores for the inference sub-scale are displayed in Table 17. Students in years one, two and four achieved their best mean scores on the inference sub-scale when compared to the remaining sub-scales of analysis and evaluation that comprise the Delphi conceptualization. When all group means and standard deviations were analyzed together, the year three group appears to have the least variation in scores while the year two group has the most variation in scores.

The overall mean score for this sub-scale of 6.29 is slightly higher then the total mean score reported by Colucciello (1997) ($x = 6.05$, $SD = 1.76$). The mean scores for participants in the four years of the program ranged from a low of 6.00 achieved by year three participants to a high of 6.58 attained by year four participants. Again, each group answered correctly at least 50% of the questions related to this sub-scale. The ANOVA shows no statistically significant difference ($F = 1.426$, $df = 3$, $p = 0.236$) among the groups. These findings are somewhat similar to those reported by Colucciello (p. 241). She found that only one group was significantly different from the others on the inference sub-scale ($p \leq .05$).

According to the conceptual framework used for this study, inference refers to the ability to recognise and obtain elements required to deduce rational conclusions; to put forth suppositions; to weigh relevant information; and to elicit the consequences which probably or necessarily follow from these elements (Facione, 1997; Facione & Facione, 1992). These type of skills require knowledge, experience and practice in a variety of forms; guidance from experts in the field; and time to develop. Given these requirements for the positive development of the abilities associated with inference, the results exhibited by these participants in this area should be considered acceptable.

Table 17. Inference Sub-scale for Years 1-4 (Maximum Marks Available = 11)

	Mean	Standard Deviation	Median	Mode	Min - Max	Range
Year 1 N = 38	6.11	1.64	6.43	7.00	3 - 9	6
Year 2 N = 53	6.28	1.79	6.25	5.00	3 - 10	7
Year 3 N = 57	6.00	1.57	5.68	5.00	3 - 9	6
Year 4 N = 80	6.58	1.64	6.73	7.00	2 - 10	8
Total N = 228	**6.29**	**1.66**	**6.42**	**7.00**	**2 - 10**	**8**

As described earlier in this report, the deductive and inductive sub-scales comprise the traditional conceptualization that is part of this study's conceptual framework. The frequency statistics for these two sub-scales are described here for participants according to their program year.

Deductive sub-scale frequency statistics for all participants. Table 18 consists of the descriptive statistics for Years 1- 4 participants' responses based on the scores for the traditional sub-scale of deductive reasoning. All four groups that participated in this study achieved better scores for this type of reasoning than they did for inductive reasoning. The mean scores for participants in the four years of the program ranged from a low of 7.79 (year three participants) to a high of 8.99 (year four participants). The ANOVA indicates that there was a statistically significant difference ($F = 2.918$, $df = 3$, $p = 0.035$) among the four groups. These findings are similar to those reported by Colucciello (1997, p. 241). She also found a statistically significant difference among three of the groups who participated in her study. The overall mean score for this sub-scale is 8.56, which is higher than the total mean score reported by Colucciello (7.89, $SD = 2.45$). When compared to the groups of participants included in Facione's (1997) aggregate report ($N = 1030$-1725), the groups' mean scores in this study were a minimum of one point higher. In fact, with the exception of the mean score achieved by year three participants, the remaining groups' scores were all higher than those achieved by 460 MSN nursing students ($x = 8.06$, $SD = 2.61$, Facione, p. 23).

Table 18. Deductive Reasoning Sub-scale for Years 1-4 (Max Marks Available - 16)

	Mean	Standard Deviation	Median	Mode	Min - Max	Range
Year 1 N = 38	8.37	3.01	8.10	6.00	3 - 15	12
Year 2 N = 53	8.89	2.29	8.59	8.00	3 - 15	12
Year 3 N = 57	7.79	2.41	5.95	5.00	4 - 12	8
Year 4 N = 80	8.99	2.48	6.73	7.00	2 - 14	12
Total N = 228	**8.56**	**2.55**	**8.46**	**8.00**	**2 - 15**	**13**

Inductive sub-scale frequency statistics for all participants. Table 19 includes the descriptive statistics for Years 1- 4 participants' responses based on the scores for the traditional sub-scale of inductive reasoning. All four groups did poorest on this sub-scale. This finding may be due in part to the placement of this category's seven items at the end of CCTST (Facione & Facione, 1992, p. 10). The inability of 38 participants to complete some or all of these questions would contribute to the low score of this type of reasoning. The mean scores for participants in the four years of the program ranged from a low of 7.11 for year two participants to a high of 7.21 for year four participants. The overall mean score for induction was 7.18 which is again slightly higher than the total mean score reported by Colucciello (1997) ($x = 6.80$, $SD = 2.19$). The ANOVA indicates no statistically significant difference ($F = .024$, $df = 3$, $p = .995$) among the four groups in this category. These findings are similar to those reported by Colucciello (p. 241). She found that only one level of students differed statistically from the other groups who participated in her study. When compared to the groups of participants (N=1031-1726) in Facione's aggregate report, the groups in this study again achieved higher scores. The differences in mean scores ranged from .28 to .53.

Table 19. Inductive Reasoning Sub-scale for Years 1-4 (Max Marks Available - 14)

	Mean	Standard Deviation	Median	Mode	Min - Max	Range
Year 1 N = 38	7.18	1.96	7.25	8.00	2 - 12	10
Year 2 N = 53	7.11	2.09	7.20	7.00	3 - 11	8
Year 3 N = 57	7.19	2.35	7.29	7.00	0 - 12	12
Year 4 N = 80	7.21	2.12	8.89	8.00	2 - 12	10
Total N = 228	**7.18**	**2.13**	**7.25**	**8.00**	**0 - 12**	**12**

Critical Thinking Dispositions of Baccalaureate Nursing Students

The second question of interest guiding this study was "What are the critical thinking dispositions of baccalaureate nursing students in Years 1, 2, 3, and 4?" This section of the report addresses the above question by describing 1) the total critical thinking dispositions scores for the participants in each year of the program 2) the total group critical thinking dispositions scores for the sub-scales: truth-seeking, open-mindedness, analyticity, systematicity, critical thinking self-confidence, inquisitiveness and maturity and 3) the critical thinking sub-scale dispositions scores of participants according to their program year.

Years 1 - 4 total critical thinking dispositions scores. The mean scores achieved on the CCTDI by each group of participants are shown on Table 20. The highest overall score achievable on the disposition inventory is 420. An overall score above 350 reflects a strong disposition, a score between 280 and 350 indicates a positive score, and a score less than 280 is evidence of an overall deficiency in the disposition toward critical thinking (Facione, 1997). The overall mean scores for the CT dispositions ranged from 304.24 (year one group) to 315.36 (year two group) with a total overall sample mean score of

312.30. Each of year's mean scores fall within the positive range of 280-350. The ANOVA indicates no statistically significant difference ($F = 0.822$, $df = 3$, $p = 0.483$) among the four groups of participants.

These findings are congruent with those reported by Colucciello (1997) and Facione (1997). First, based on her sample of 328, Colucciello reports overall mean scores between 290.90 and 315.24. The total overall mean score for her total sample was 306.88 (SD=30.89), slightly lower than that achieved by the sample who participated in this study. Facione's report on the CTD overall mean scores were as follows:

1) 570 nursing sophomores - 310.4

2) 817 nursing juniors - 308.0

3) 1035 nursing seniors - 311.4

Again the above scores are only 4.3 to 0.9 points less than those achieved by the participants of this study.

As evident in Table 20, the overall scores ranged from 136 to 392; however, it is noteworthy that only 1.8% of all the participants scored below 280 and 12.70% of all participants scored above 350. More than 16% of participants from the four year group achieved a score greater than 350, whereas only 2.63% of year one participants achieved these scores. It is reassuring to note that the majority of participants (85.50%) scored between 280 and 350. When considered individually, 82% of participants in each year scored above 280. Although year two participants achieved the highest overall mean score, they also showed the greatest variation, as evidenced by largest standard deviation (40.07) and largest ranges of scores (256). The year three participants showed the least variation with a standard deviation of 27.21 and a range of 108.

Table 20. Years 1 - 4 Total Critical Thinking Dispositions Scores (Maximum 420)

N = 228	Mean	Standard Deviation	Median	Mode	Min - Max	Range
Year 1	304.24	32.14	310.00	270	210-379	169
Year 2	315.36	40.07	317.00	293	136-392	256
Year 3	313.52	27.21	314.25	295	252-360	108
Year 4	312.68	36.74	317.40	319	182-387	205
All Years	**312.30**	**36.36**	**315.62**	**319**	**136-392**	**256**

Years 1 - 4 critical thinking disposition sub-scales scores. The mean scores achieved by the four groups of participants for each of the seven sub-scales represented on the CCTDI are displayed in Table 21. The maximum score achievable on any of the dispositions is 60. A score higher than 50 on any of the sub-scales reflects a strength in that disposition. A score between 40 and 50 reveals a positive inclination. Scores between 31 and 39 show an ambivalent inclination to the specific disposition; whereas, scores of 30 or lower indicate a negative tendency (Facione, 1997).

Of all sub-scales, only the truth-seeking sub-scale had mean scores below 40. It is interesting to note that the highest mean score was achieved for the sub-scale of inquisitiveness (48.99) which reflects curiosity and the eagerness to obtain knowledge even when this knowledge may not have immediate use. Again this finding parallels the results reported by Colucciello (1997) and Facione (1997). In her study Colucciello reported that inquisitiveness had the highest mean score (47.67) for all participants. Similarly, Facione reported that each group of undergraduate nursing students in the aggregate data analysis achieved a mean score slightly above 48 on the inquisitiveness sub-scale. The level of inquisitiveness noted for the participants from the three different studies is both encouraging and desirable. In a practice discipline such as nursing it is important that students at all educational levels maintain a curious nature and continue their pursuit of knowledge. Facione, Sanchez, Facione and Gainen (1995) support this belief in their statement that "the knowledge base for competent...nursing practice

continues to expand, a deficit in inquisitiveness would signal a fundamental limitation of one's potential to develop expert knowledge and professional practice" (p. 4).

The lowest score (37.56) was achieved by participants on the truth-seeking sub-scale. As described in Chapter Three of this report, Facione, Facione and Giancarlo (1996) indicated that truth-seeking gauges intellectual honesty, courage to acquire the best knowledge, the inclination to ask challenging questions, and the willingness to pursue evidence and proof regardless of where it may lead. Only 37.28% of the participants achieved truth-seeking scores between 40 and 50 and an even smaller percentage (1.75%) obtained scores above 50. Thus, most of the participants obtained scores less than 40 reflecting an ambivalent or negative inclination toward truth-seeking. Facione, Sanchez, Facione and Gainen (1995) believe that remaining un-attuned to evidence which is different than one's view sustains professional practice which does not reflect nor respond to changes in its theory base. A lack of truth-seeking behaviors may endanger a client if the nurse does not pay attention to the evidence that points to a patient's missed diagnosis or to cues indicating a change in his/her status.

The findings reported above are analogous to those reported in Colucciello's (1997) study and in Facione's (1997) aggregate data analysis. The 328 participants in the first study had an overall mean of 38.37 on the truth-seeking sub-scale; this was the lowest of the sub-scale means. The data analysis conducted by Facione also revealed truth-seeking as the lowest sub-scale for all levels of undergraduate nursing students. Their mean scores ranged from 38.22 (N = 817) for the junior group to 38.72 for the sophomore group (N = 580). These consistently low scores in all three studies beg the question, "Why are undergraduate nursing students not disposed to seeking the truth?" Colucciello (1997) attributed the students' weakness on this sub-scale to the didactic-oriented teaching that currently exists in many educational institutions - students are expected to learn volumes of information presented in the form of lectures. Students assume a passive stance during lectures, thus limiting the opportunity for the exchange of knowledge, minimizing time for discussion, and restricting the quest for inquiry. In this writer's experience students have struggled when they have been encouraged to raise

questions or dialogue about issues presented in the context of lectures. When nursing students were challenged about this behaviour, some have been courageous enough to share that indeed some nurse educators do not foster a learning environment where questions are welcomed. Other educators regard questions as an inconvenience in their time constrained lectures. As a result, some of these nursing students have learned not to ask questions and have accepted what they have been told without challenge.

In the current study most participants achieved scores between 40 and 50 on the open-mindedness sub-scales and scores above 50 on the analyticity sub-scale (42.10%). Based on ANOVA, the only statistically significant difference ($F = 3.582$, $df = 3$, $p = .015$) among the four groups of participants was found on the systematicity sub-scale. Systematicity refers to an individual's habit of being organized, orderly, focused, and diligent in his or her pursuit of inquiry (Facione, Facione, & Giancarlo, 1992). These habits can be achieved in a variety of ways. As reported in Table 21 the scores for systematicity are higher for third (43.38) and fourth year (43.44) students than they are for first year (39.11) and second year (42.30) nursing students. The differences in these scores suggest that nursing students' experiences in their individual courses and their general program expectations play a role in the ability to become more systematic in their approach. A review of several theoretical and nursing practice course outlines and related assignments reveals that systematicity is very much valued and expected by nurse educators.

As indicated in Table 21 the greatest range of scores (50) was achieved on the inquisitiveness sub-scale; however, the overall inquisitiveness mean scores for each group of participants differed little. The high range in score can be attributed to the Year 2 scores (Table 23). The smallest range is reported for open-mindedness (34): no participant scored less than 26 on this sub-scale.

Less than 1.0% percentage of the participants were able to realize the maximum score attainable (60) on three of the sub-scales: open-mindedness (0.5%), CT confidence (0.9%) and inquisitiveness (0.5%). Although Facione (1997) does not report any undergraduate nursing student achieving a score of 60 on the open-mindedness sub-scale,

she does report maximum achievement on the CT confidence and inquisitiveness sub-scales. Because Colucciello (1997) does not report the maximum scores achieved by her sample of undergraduate nursing students it is not possible to ascertain whether any of the participants achieved such a score.

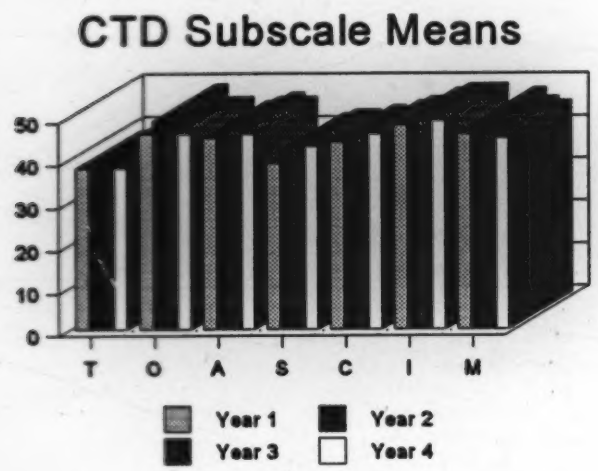
Table 21. Years 1 - 4 Critical Thinking Sub-scale Disposition Scores

N = 228	Mean	Standard Deviation	Median	Mode	Min - Max	Range
Truth-seeking	37.56	6.85	37.48	38	13-56	43
Open-mindedness	46.49	5.90	46.89	43	26-60	34
Analyticity	45.80	5.46	45.35	44	15-58	43
Systematicity	42.41	7.17	43.55	45	13-59	46
CT Confidence	44.68	7.15	44.92	46	14-60	46
Inquisitiveness	48.99	7.18	50.18	52	10-60	50
Maturity	46.13	7.35	46.82	49	13-60	47

Maximum score achievable for each disposition - 60

Table 21 contains the seven critical thinking dispositions' mean scores for the total sample of 228. The scores achieved by each of the four groups for each of the seven dispositions are depicted in Figure 1. The scores for each year are also presented and discussed in the following pages

Figure 1: Critical Thinking Dispositions Sub-scales Means for Years 1-4



T = Truth-seeking
O = Open-mindedness
A = Analyticity
S = Systematicity
C = CT Self-confidence
I = Inquisitiveness
M = Maturity

Year 1 critical thinking sub-scales disposition scores. Table 22 includes the mean scores achieved by the first year group of participants for each of the seven sub-scales based on the CCTDI. Similar to the total group of participants, the year one group's highest mean score (48.30) was achieved for the inquisitiveness sub-scale and the lowest mean score (37.76) was for the truth-seeking sub-scale. Based on the norms provided by Facione (1997), their mean score fell between the 40th and 50th percentile (p. 82). Unlike any of the other three groups who were part of this study, year one participants also achieved less than 40 (39.11) on the sub-scale of systematicity. The results on the systematicity sub-scale varied from those reported by Colucciello (1997) and Facione (1997). Mean scores for comparable levels of nursing students in these two reports were above the target score of 40. Based on the norms provided by Facione, this mean score was between the 20th and 30th percentile rank.

On the sub-scale of truth-seeking only 2.63% of year one participants scored over 50, and 36.84% of them scored between 40 and 50. Most (42.10%) of year one participants scored between 31-39, reflecting an ambivalent disposition and 18.42% scored less than 31, indicating that they had a tendency toward "intellectual bias or toward

firmly holding to opinions regardless of the sound contrary reasons or counter-evidence" provided (Facione, 1997, p. 53). Knowing that varied perspectives about a multitude of aspects exist in every area of nursing, it is imperative that nursing students be open-minded. An open-minded attitude can be fostered by nurse educators through the use of various approaches such as debates, structured controversies and written assignments. These strategies can be specifically designed to challenge students to determine the legitimacy of their own views against the arguments or evidence of others who hold divergent views (Facione, 1997).

On the sub-scale of systematicity, the majority (47.37%) of year 1 participants scored between 31 and 39, indicating an ambivalence to being focused, diligent and persevering. The next highest percentage (36.84%) of participants scored between 40 and 50, demonstrating a strength toward organized approaches. Slightly over ten percent achieved a strong disposition toward organization. The smallest percentage (5.26%) of year 1 participants demonstrated a negative inclination toward focusing, diligence and perseverance.

Table 22. Year 1 Critical Thinking Dispositions Scores

N = 38	Mean	Standard Deviation	Median	Mode	Min - Max	Range
Truth-seeking	37.76	7.08	37.83	38	19-55	36
Open-mindedness	46.03	5.86	46.70	47	28-55	27
Analyticity	45.19	4.92	44.20	45	35-55	20
Systematicity	39.11	6.67	43.55	45	29-54	25
CT Confidence	44.19	6.28	45.00	41	29-57	28
Inquisitiveness	48.30	7.20	50.00	54	29-59	30
Maturity	45.68	7.84	47.33	42	23-58	35
TOTAL SCORES	**304.24**	**32.14**	**310.00**	**270**	**210-379**	**169**

Maximum score achievable for each disposition - 60

Year 2 critical thinking sub-scales disposition scores. The mean scores achieved by the second year participants for each of the seven sub-scales based on the completion of the CCTDI are shown in Table 23. Similarly to the total group of participants, the year two group achieved the highest mean score (49.22) on the inquisitiveness sub-scale and the lowest mean score on the truth-seeking (38.54) sub-scale. Based on the norms provided by Facione (1997), their mean score for inquisitiveness fell between the 40th and 50th percentile and their mean score for truth-seeking was between the 50th and 60th percentile (p. 83). With the exception of the mean score on the CT self confidence, this group's mean scores for the other six sub-scales were higher than those reported for similar levels of students (Colucciello, 1997). When contrasted with the group in Facione's (1997) aggregate report, this study's participants scored lower only on the sub-scales of systematicity and CT self confidence.

On the sub-scale of truth-seeking, only 1.88% of the year two participants scored over 50, and 37.73% of them scored between 40 and 50. In comparison to year one participants, the greatest majority (52.80%) of year two participants scored between 31-39 on the truth-seeking sub-scale, reflecting an ambivalent disposition. This finding indicates that the majority of these students are more likely to agree with such statements as "Even if the evidence is against me, I'll hold firm to my beliefs", "I believe what I want to believe", and "Many questions are just too frightening to ask". (Facione & Facione, 1992, pp. 2-4). However, only 7.5% of the participants scored less than 31, compared to 18.42% of first year participants. These results indicate that fewer members of the second year group have an inclination "toward intellectual bias or toward firmly holding to opinions regardless of the sound contrary reasons or counter-evidence" provided (Facione, 1997, p. 53).

The sub-scale of systematicity was the year two participants' second lowest mean score (42.30), even though it was above the target score of 40. The majority (54.71%) of these participants would generally disagree with such statements: "People say I rush into decisions too quickly.", "My opinion about controversial topics depends a lot on who I talk to last.", and " People think I procrastinate about making decisions." (Facione &

Facione, 1992, pp. 2-3). It is reassuring to note that greater than 90% of the year two participants achieved scores equal to or greater than 40 on all remaining sub-scales with the exception of CT self-confidence: 79.25% achieved a score equal to or greater than 40 for this sub-scale.

Table 23. Year 2 Critical Thinking Dispositions Scores

N = 53	Mean	Standard Deviation	Median	Mode	Min - Max	Range
Truth-seeking	38.54	6.43	37.75	38	27-56	29
Open-mindedness	48.48	5.52	48.46	48	28-58	30
Analyticity	45.46	6.77	45.10	45	15-57	42
Systematicity	42.30	8.09	44.50	47	13-53	40
CT Confidence	42.98	8.07	49.85	49	14-57	43
Inquisitiveness	49.22	7.72	43.14	49	10-60	50
Maturity	48.28	7.43	49.00	54	20-60	40
TOTAL SCORES	315.36	40.07	317.00	293	136-392	256

Maximum score achievable for each disposition - 60

Year 3 critical thinking sub-scales disposition scores. The mean scores achieved by third year participants for each of the seven CCTDI sub-scales are displayed in Table 24. This group achieved above the target score of 40 on six of the seven sub-scales. Again, similar to the total group of participants, the sample from year three achieved the highest mean score (49.11) on the inquisitiveness sub-scale and the lowest sub-scale mean score on the truth-seeking sub-scale (37.29). Based on the norms (N=817) provided by Facione (1997), their mean score for inquisitiveness was between the 40th and 50th percentile and their mean score for truth-seeking fell between the 40th and 50th percentile (p. 83). The current participants, when compared to a similar level of students in Colucciello (1997) study and Facione's (1997) aggregate report, scored higher on open-mindedness, analyticity, CT self-confidence and inquisitiveness and lower on truth-

seeking, systematicity and maturity. The greatest difference between the two groups (2.13 and 2.95 respectively) was evident in the sub-scale of analyticity, and the smallest difference was noted on the sub-scale of inquisitiveness (.23 and .31 respectively).

Unlike the other three groups in this study who had a small percentage of participants score above 50 on the sub-scale of truth-seeking, none of this group scored over 50. However the percentage (33.33%) of those who scored between 40 and 50 was comparable to the other three groups. Again the majority (54.39%) of year three participants achieved a score between 31 and 39 on the truth-seeking sub-scale, reflecting an ambivalent disposition. The percentage (7.5%) of those who scored less than 31 was similar to that of year two and approximately 11% less than that of the year one sample. Despite the fact that entry level scores for truth-seeking were not available for these groups to ascertain whether these current scores have changed over time, the fact that Year 3 participants had the lowest mean score on truth-seeking is still cause for concern. This score may indicate that advancement in a nursing education program does not mean enhancement in students' truth-seeking ability. Indeed these scores may signify that this nursing education program may not foster a positive inclination toward receptivity of additional, new, and contradictory evidence and perspectives.

Table 24. Year 3 Critical Thinking Dispositions Scores

N = 57	Mean	Standard Deviation	Median	Mode	Min - Max	Range
Truth-seeking	37.29	6.40	36.86	33	21-50	29
Open-mindedness	46.29	4.86	46.14	43	37-58	21
Analyticity	46.98	4.56	47.10	48	35-57	22
Systematicity	43.38	6.43	44.36	44	26-57	31
CT Confidence	44.73	6.55	45.00	46	30-58	28
Inquisitiveness	49.11	6.14	50.71	53	33-59	26
Maturity	45.75	5.80	46.00	44	32-58	26
TOTAL SCORES	**313.52**	**27.21**	**314.25**	**295**	**252-360**	**108**

Maximum score achievable for each disposition - 60

Year 4 critical thinking sub-scales disposition scores. The mean scores achieved by the fourth year group of participants for each of the seven CCTDI sub-scales are included in Table 25. Similarly to the participants from year 2 and 3 this group also achieved mean scores above 40 on six of the seven sub-scales. Again, like the total group of participants, the sample of participants from year four achieved the highest mean score (49.10) on the inquisitiveness sub-scale and the lowest sub-scale mean score was obtained on the truth-seeking sub-scale (37.51). Based on the norms (N=1040) provided by Facione (1997), their mean score for inquisitiveness was between the 50th and 60th percentile and their mean score for truth-seeking fell between the 30th and 40th percentile (N= 1041, p. 83). Compared to a similar level of students in Colucciello's (1997) study (N=46), year four participants scored higher on analyticity, systematicity and CT self-confidence, and lower on the remaining four sub-scales. In comparison to the sample used in Facione's (1997) aggregate report, the participants from this study scored higher on analyticity, CT self-confidence and inquisitiveness and lower on truth-seeking, open-mindedness, systematicity and maturity. The greatest difference between this sample and those in Colucciello(1997) and Facione's (1997) work was evident in the sub-scale of analyticity and CT self-confidence. The smallest difference was noted on the sub-scale for open-mindedness.

It is noteworthy that only 2.5% of the fourth year participants scored above 50 on the sub-scale of truth-seeking: most of the participants (55%) from this group scored 39 or less. In total, 42.5% of the participants scored between 40 and 50. With the exception of the inquisitiveness sub-scale, the majority of year four participants scored between 40 and 50. These percentages ranged from 52.75% on the CT self-confidence sub-scale to a high of 70.00% on the analysis sub-scale. The majority of participants (50.55%) from this groups scored above 50 on the inquisitiveness sub-scale, indicating a strong inclination. Although the majority of participants in this group scored above 40 on six of the seven sub-scales (Table 25) some achieved scores less than 40. Indeed some of these participants, who were only weeks away from program completion, scored as low as 13 on the sub-scales of truth-seeking and maturity. Despite the fact that this group

comprised a smaller number of individuals, these scores should be cause for concern. For example, 24% of participants in this group scored less than 40 on the sub-scale of systematicity. Recall that this sub-scale measures the inclination to be "organized, orderly, focused and diligent in inquiry" (Facione, Sanchez, Facione & Gainen, 1995, p. 7). It is the belief of this writer that nursing practice requires nurses who are able to approach patient care and situations that require problem-solving and decision-making, in a way that reflects the qualities listed above. Consider what the consequences and implications might be if nurses were to approach the variety of activities in their day-to- day practice in a chaotic, unfocused, haphazard, lazy and unreliable manner.

Table 25. Year 4 Critical Thinking Dispositions Scores

N = 80	Mean	Standard Deviation	Median	Mode	Min - Max	Range
Truth-seeking	37.51	7.41	37.50	43	13-56	43
Open-mindedness	45.53	6.67	46.00	34	26-60	34
Analyticity	45.88	5.23	45.43	30	28-58	30
Systematicity	43.44	6.91	44.15	33	26-59	33
CT Confidence	46.05	7.20	46.50	34	26-60	34
Inquisitiveness	49.10	7.64	50.33	31	28-59	31
Maturity	45.18	7.95	46.00	44	13-57	44
TOTAL SCORES	**312.68**	**36.74**	**317.40**	**205**	**182-387**	**205**

Maximum score achievable for each disposition - 60

The Relationship Between Critical Thinking Skills and Critical Thinking Dispositions

One question in this study was specifically developed to address the relationship between critical thinking skills and critical thinking dispositions. As indicated in the literature review, studies exploring this relationship are sparse. Two reports included in the literature review addressing this relationship were those published by Colucciello (1997) and Facione (1997). Both researchers report a positive correlation between the

critical thinking skills and critical thinking dispositions. The results of this research study also support such a relationship. Based on chi-square for independence ($\chi^2 = 9.37$, $p = .014$, power $>.80$), there was a significant relationship between the participants' critical thinking skills and their critical thinking dispositions. Although further research studies are needed to confirm this relationship, these findings appear to support the belief expressed by many authors that both cognitive skills and the affective component need to exist in order for an individual to be an effective critical thinker.

CHAPTER 5

Summary, Limitations, Recommendations and Conclusion

Overview

Thus far in this dissertation the importance and need for critical thinking in nursing and the rationale behind the researcher's interest in studying such an important concept has been introduced. The extensive literature review which has been presented in Chapter 2 has contributed significantly to this researcher's understanding of critical thinking skills and dispositions. As well it provided this researcher with additional ideas to articulate recommendations and areas for further research, all of which are presented later in this chapter. The design and methodology underpinning this research study are delineated in Chapter 3. In chapter 4 the findings are combined with the related discussion to enhance readability. This final chapter is a summary of the major findings of this dissertation; it combines the study limitations, recommendations for nursing education/nurse educators, and suggestions for further research that will serve as part of a blueprint for this writer's program of research.

Summary

The purpose of this study, which used a cross-sectional, correlational, descriptive design, was to investigate the critical thinking skills and the disposition toward critical thinking of nursing students enrolled in a four year baccalaureate nursing program at the Faculty of Nursing, University of Alberta. It was also the intent to determine the relationship between specific variables and the students' critical thinking skills. The variables studied were: age and gender; level of academic achievement prior to entering the nursing program; year of program; experience with problem-based learning; and previous completion of a university level course specifically designed to teach students how to think logically, to improve their reasoning, or to sharpen their critical thinking skills.

The conceptual framework used for this study encompassed the two dimensions of critical thinking. These dimensions comprised both cognitive skills and affective dispositions as described by Facione and Facione (1992). This study, as well as the study

by Colucciello and the aggregate report by Facione, shows that these two dimensions are related to each other in a significant way.

The convenience sample of 228 nursing students across all four years of the baccalaureate program completed three instruments: a background/demographic questionnaire specifically designed for this study, the California Critical Thinking Skills Test (CCTST) Form A, and the California Critical Thinking Disposition Inventory (CCTDI). The background/demographic questionnaire yielded descriptive data related to the aforementioned variables. The scoring of the CCTST produced scores for the five sub-scales (analysis, evaluation, inference, inductive, and deductive), as well as an overall score. Similarly, scoring of the CCTDI generated an overall score, plus scores for the seven individual sub-scales (truth-seeking, inquisitiveness, open-mindedness, analyticity, systematicity, maturity, and critical thinking confidence). The CCTST and the CCTDI instruments, which were used as the tools for this study, have been valuable in assessing the participants' critical thinking skills and dispositions respectively. They are the most current quantitative type tools available to assess the above two dimensions; they are based on a substantive Delphi conceptualization developed by several experts in their fields; and they have been found to have an acceptable level of reliability and validity (as described in Chapter 3). In addition, the combined administration of these two tools allowed this researcher to confirm whether there was a significant relationship between critical thinking skills and dispositions. Nonetheless, despite their positive characteristics, the CCTST and CCTDI were challenging to use. Some of the challenges were related to the time frame needed for administering the tools and the level of difficulty experienced by some students in completing the CCTST. It is also important to note that these two instruments are only one way to assess critical thinking skills and dispositions. Although it was not the purpose of this study to establish whether there was a relationship between the CCTST and CCTDI with other measures of critical thinking (ie. participatory observation, students' written work, and clinical practice), this study served to reinforce that this work needs to be conducted in order to gain a holistic view of the student's abilities in these two domains.

Major results indicate that the total sample achieved a mean of 17.43 out of a possible score of 34 on the CCTST. Year means ranged from 16.72 to 17.94, which fall between the 60th and 70th percentile based on norms for undergraduate nursing students calculated by Facione (1997). Years one, two and four achieved their best scores on the inference sub-scale. Year three attained its best score on the analysis sub-scale. The critical thinking sub-scale evaluation had the lowest mean score for all four groups. Analysis of variance (ANOVA) indicated no significant difference among the four groups of students on the overall critical thinking mean scores ($p = .05$).

The mean scores for the CT dispositions ranged from 304.24 to 315.36, with an overall sample mean score of 312.30 (positive score). Overall, 12.70% of participants scored above 350, reflecting a solid indication of across the board strength in the disposition toward critical thinking (Facione, 1997); 85.50% of all participants scored between 280 and 350 (positive score); and only 1.8% of all participants scored below 280, demonstrating a general deficiency in the disposition toward critical thinking. The sample scored lowest on the truth-seeking sub-scale, reflecting an ambivalent inclination. The highest score was achieved in the sub-scale of inquisitiveness, indicating a positive inclination. Using ANOVA, the only significant difference among participants in Years 1 to 4 was on the sub-scale of systematicity. Based on the statistical analysis chi-square for independence ($\chi^2 = 9.37$, $p = .014$, power $> .80$), there was a highly significant relationship between the participants' overall critical thinking disposition scores and their overall critical thinking skills scores.

Study Limitations

Limitations Affecting Internal and External Validity

There are limitations to be considered in interpreting the data in this study. First, the sample was one of convenience and the number of students who chose to participate was only 35.13% of the total population; therefore, sampling bias may have existed which limits generalizability to other populations of baccalaureate nursing students. Those who chose to participate may have been similar or quite different than the non-participants in the areas of critical thinking skills, dispositions, and some of the

background/demographic variables. Except for a few variables such as gender and age, which were available for the total population, there was no way to ascertain how participants differed from non-participants.

Secondly, testing bias may have been a factor in this study. Daily fluctuations in the mood of the students and their attitude toward completion of the questionnaire, inventory and test may have affected their performance on the CCTDI and the CCTST and the accurate completion of their background and demographic data. Although these factors were beyond the control of the researcher, it is assumed that the participants responded to all the items in a truthful manner and to the best of their abilities.

Thirdly, the conditions of testing may have varied slightly from group to group in relation to directions given, as well as environmental factors such as room temperature and noise. The use of a written script (Appendix F) delivered by the investigator to all students was strictly followed to offset any possible variation in the presentation of information, but it is possible that the approach to groups of students and the specific presentation of information regarding the study may have varied slightly on any given day. Because data collection was completed in different classrooms across campus, it was not possible to ensure constant environmental conditions such as temperature, light and noise. These diverse conditions may have influenced participants' ability to concentrate and accurately respond to questions on any of the three instruments.

Fourthly, errors may have occurred in the scoring as well as the transcription of data from paper form to the computer. In order to minimize and monitor these errors, 10% of randomly selected computer scored answer sheets were hand scored. In addition, randomly selected data recorded on the printout were visually verified by comparing it with the original source. Very few errors were detected.

Next, the purpose of this study was to measure the students' critical thinking skills at a point in time. This study did not allow for the externalization of students' critical thinking process evident when alternate assessment tools such as the Holistic Scoring Rubric (Facione & Facione, 1996) are used or for those techniques that allow for observations of participants in group and/or clinical settings.

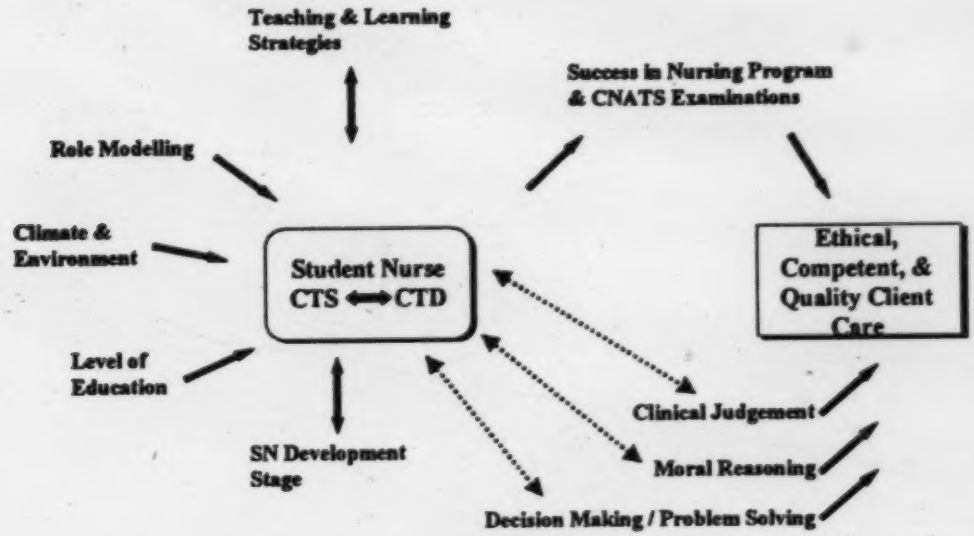
Lastly, this study used a cross-sectional design and thus did not permit the assessment of critical thinking skills and dispositions with the same students over a specific period of time such as one academic year and/or entry and exit periods. The participants' scores may have increased or decreased significantly or remained unchanged from one year to the next and/or from entry to exit.

Preliminary Model for Nursing Education and Practice

Completion of this study, which includes a comprehensive review of the critical thinking literature, analysis of the findings, and reflection on the overall process was instrumental in assisting this writer to propose a preliminary model that may have some utility for nursing education, practice, and future research.

Teaching and learning, role modelling, climate/environment, levels of education, students' developmental phases, and success in nursing programs and the Canadian Nurse Association Testing Services (CNATS) licensure examinations were variables drawn from the literature review. The nursing student's critical thinking skills (CTS) and its relationship to critical thinking disposition (CTD), depicted within the model, was a major finding in this study and was also supported by Colucciello's study and Facione's aggregate report. In some studies clinical judgement, moral reasoning, and decision-making/problem solving have been linked to critical thinking and critical thinking dispositions; however, further investigations is warranted. The ethical, competent, and quality component of client care represents the outcome that nurses should strive for in clinical practice. An initial conceptualization of the model is offered in Figure 2 to encourage dialogue among nurse educators:

Figure 2: Preliminary Model for Nursing Education and Practice



Recommendations

Recommendations for Further Research

Based on this research study recommendations for future research studies include the following areas/topics:

- Replication studies need to be conducted with groups of randomly selected baccalaureate nursing students from various programs across Canada using the CCTST, the CCTDI, and background/demographic instruments.
- Longitudinal studies including the same cohort of baccalaureate students from Year 1 through Year 4 should be carried out to ascertain whether there is a change in the students' CTS and CTD upon completion of a baccalaureate nursing program.
- Investigations should be undertaken to compare the critical thinking skills and dispositions of baccalaureate nursing students who complete accelerated or condensed nursing programs with those baccalaureate nursing students enrolled in generic four year baccalaureate programs.

- Correlational studies should be initiated to determine the relationship between students' CTS & CTD, based on the completion of available instruments, and their behaviour in various settings such as small group activities and clinical practice.

Recommendations for further research studies drawn from the literature review and the recommendations made by numerous other authors (Beck, Bennett, McLeod, Molyneaux, 1992; Facione, Facione, & Sanchez, 1994; Gonzalez, 1996; Kintgen-Andrews, 1991; Maynard, 1991; McGovern, & Valiga, 1997; Pless & Clayton, 1993; Saucier, 1995) are reflected below in the form of questions:

- How do Canadian baccalaureate nursing programs define critical thinking? How is critical thinking reflected in the program's documents, characteristics of critical thinking activities, strategies to teach critical thinking in the classroom and clinical practice settings? What strategies are in place to assess the critical thinking of students in the classroom and clinical practice?
- Based on assessments done in the classroom and clinical practice settings what critical thinking skills do nursing students possess? These skills need to be assessed using both qualitative and quantitative approaches.
- What teaching and learning strategies foster critical thinking skills and dispositions? These need to be determined using quasi-experimental and true experimental designs.
- What is the relationship between critical thinking and clinical judgement, creative thinking, and reflective thinking among baccalaureate nursing students?
- What is the relationship between nursing students' critical thinking skills and dispositions and nursing students' levels of intellectual and ethical development based on Perry's (1970) schemes?
- What are the critical thinking skills and dispositions of nurse educators and are they related to the critical thinking skills of students in the nurse educators' respective programs?

- What are the critical thinking skills and dispositions of nursing students prepared in Canada at the diploma, baccalaureate, masters and doctoral programs?
- How do the critical thinking skills and dispositions of nursing students compare to the critical thinking skills and dispositions of students enrolled in other disciplines at entry and completion of their respective programs?
- What are the critical thinking skills and dispositions at entry and exit of nursing education programs, and in practice settings one year and five years post baccalaureate education?
- What are the critical thinking skills and dispositions of registered nurses and how are they related to clinical decision-making, moral reasoning, and professionalism?
- What is the impact of nurses' critical thinking abilities on quality of care specifically in such areas as assessment, interventions and evaluations? What is the impact of nurses' critical thinking abilities on patient outcomes such as shorter length of stay in acute care facilities, increased knowledge level of individuals, decrease in rates of re-hospitalization, decline in the number of adverse events such as development of infections and incidences of falls?
- How effective are existing models of critical thinking in formulating teaching and learning approaches and curriculum designs?
- What is the correlation between critical thinking skills and dispositions and success in nursing based on GPA and CNATS examination results?

Implications/Recommendations for Nursing Education and Nurse Educators

- Nurse educators must initiate dialogue and create functional structures that allow them to share with one another their individual conceptualization of critical thinking. They must consider the role of critical thinking in their courses, and how they assess and measure it.
- Nurse educators need to participate in teaching and research that explores the relationship between critical thinking and nursing performance, moral reasoning, clinical judgement, and professionalism. They must strive to promote such relationships.

- Nurse educators must initiate seminars that focus specifically on critical thinking, structuring of classes to promote critical thinking, and the construction of effective written and other types of assignments.
- The highly significant relationship between CTS and CTD suggests that nurse educators must focus their work and efforts not only on skills but also on the students' habits of mind or dispositions.
- Nurse educators should critically analyze how much emphasis they place on "how to think" (process) versus "what to think" (content).
- Nurse educators need to scrutinize curriculum plans, course structures, course assignments, and teaching strategies to ascertain how critical thinking is defined, how it is operationalized, and how its progression as part of these structures is nourished or obstructed.
- From their initial socialization into the profession, nursing students work with other nurses (including instructors). Some authors have suggested that there is a strong association between role modelling, mentorship and the students' level of critical thinking and dispositions. Nurse educators need to explore this relationship and consider how they role model CTS and CTD both in the classroom and in the practice setting.
- Nurse educators need to identify, measure, and motivate thoughtful, fair-minded engagement in problem-solving, decision-making, and professional judgement. There is a need to prepare graduates who are able and willing to think (Facione, Facione, & Giancarlo, 1997).
- Nurse educators need to create assessment portfolios which comprise a collection of multiple (reliable and valid) measures of thinking that may be used to observe the progress, strengths and areas of weakness of nursing students (Facione & Facione, 1996).
- Nurse educators need to cultivate a culture of reasoned thinking and evidence-based inquiry (Facione & Facione, 1996). This can be achieved through "exemplary practices in program design, course design..., assessment of teaching

for critical thinking, and teaching strategies..." (Paul, 1997, p. viii).

- Nurse educators need to replace rote training with thoughtful mentoring. Education is knowing 'whether and why' not just 'what, how, and when'. They need to challenge students by asking probing questions and regularly questioning them Socratically, demanding understandable explanations, questioning untested assumptions, allowing students to correct themselves, and mixing nurture with challenge. Nurse educators should point the way to learning - not spoon feed solutions (Facione & Facione, 1996; Paul, 1997).
- Nurse educators should use content as a mode of thinking. Paul (1997) has suggested that the most pragmatic thing we can do as nurse educators is to introduce the course content as a mode of thinking. For example, for a historical nursing course, the educator can indicate 'This is a historical nursing course and therefore the key goal is to learn to think historically.' Moreover, nurse educators need to think through how historical thinking is essential to the daily and professional thinking of nursing students (pp. v & xii).
- Nurse educators should present information from the bottom up. They should not begin with principles and definitions but with examples which are so captivating that learners want to procure the targeted content and skills. Real and practice-based studies are excellent vehicles for the integration of content, skills and dispositions. Cases stimulate students to think through a problem and make decisions in a spontaneous, authentic and unrehearsed manner. Nurse educators should also encourage students to think out loud as they work through cases (Facione & Facione, 1996).
- Nurse educators should evaluate processes as well as results. Although completed papers or projects can be evaluated for assignment of grade, the process must be appraised to cultivate critical thinking skills and reinforce dispositions (Facione & Facione, 1996; Paul, 1997).
- Nurse educators should foster cognitive virtues such as inquisitiveness, open-mindedness and systematicity. In order to sustain high calibre work rather than

substandard or minimal performance, rewards, reinforcements, and support needs to flow to individuals who are capable and aspire to think (Facione & Facione, 1996).

Conclusion

The results of this study indicate that the vast majority of nursing students who participated had adequate levels of critical thinking skills and dispositions. These results also reinforce the need for students' continued development in some of these areas. Nurse educators must renew their commitment to critical thinking as an educational ideal and this ideal must be continually pursued because it is integral to true autonomy in our complicated society (Jones & Brown, 1991). This writer supports Moore's (1990) assertion that critical thinking is the central ingredient in the development of nurses who are dedicated to developing, using, and reconsidering theories which allow them to best meet the needs of their clients. Critical thinking encompasses the necessary cognitive skills that nurses need to continue searching for clarity and striving for answers, "for what body of knowledge ever has found all the answers?" (p. 826). Moreover, critical thinking enjoins us to search for answers and beckons us to examine the ideas that confront us.

"Who could argue the importance of critical thinking in nursing?" asks Burnard in his 1989 article (p. 275). Its importance to education, practice, research, and nursing theory is indisputable. Nurses deal with an ever increasing number of demands associated with educational changes, health care reform, and professional and practice issues. These challenges necessitate that nursing students and professional nurses involved in every area of nursing employ effective critical thinking skills.

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Appendix A

Critical Thinking Cognitive Skills and Sub-Skills

"We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based..."

Critical Thinking Cognitive Skills and Sub-Skills

Interpretation	• Categorization • Decoding Sentences • Clarifying Meaning
Analysis	• Examining Ideas • Identifying Arguments • Analyzing Arguments
Evaluation	• Assessing Claims • Assessing Arguments
Inference	• Querying Evidence • Conjecturing Alternatives • Drawing Conclusions
Explanation	• Stating Results • Justifying Procedures • Presenting Arguments
Self-Regulation	• Self Examination • Self Correction

From Table 1, Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction, "The APA Delphi Report" (1990). ERIC Document Number: 315 423.

Appendix B

The Disposition Toward Critical Thinking Seven Factor Analysis

"The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgements, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit..." From Table 1, Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction, "The APA Delphi Report" (1990). ERIC Document Number: 315 423.

The Disposition Toward Critical Thinking
Seven Factor Analysis

- **Truthseeking:** A courageous desire for the best knowledge, even if such knowledge fails to support or undermine one's preconceptions, beliefs or self interests.

- **Open-Mindedness:** Tolerance to divergent views, self-monitoring for possible bias.

- **Analyticity:** Demanding the application of reason and evidence, alert to problematic situations, inclined to anticipate consequences.

- **Systematicity:** Valuing organization, focus and diligence to approach problems of all levels of complexity.

- **CT Self-Confidence:** Trusting of one's own reasoning skills and seeing oneself as a good thinker.

- **Inquisitiveness:** Curious and eager to acquire knowledge and learn explanations even when the applications of the knowledge are not immediately apparent.

- **Maturity:** Prudence in making, suspending, or revising judgment. An awareness that multiple solutions can be acceptable. An appreciation of the need to reach closure even in the absence of complete knowledge.

From: "The California Critical Thinking Dispositions Inventory": (C) Facione, N.C. & Facione, P.A. (1992).

Appendix C

Letter of Approval to Access Students

University of Alberta
Edmonton

Faculty of Nursing
Office of the Dean

Canada T6G 2G3

Third Floor Clinical Sciences Building, Telephone (403) 492-6236
Fax (403) 492-6029
E-mail: mwood@ua-nursing.ualberta.ca

January 13, 1997

Dr. Beverly O'Brien
Chair of Ethics Review Committee
Faculty of Nursing
University of Alberta

Dear Bev:

I have reviewed a summary of the research dealing with Critical Thinking Dispositions and Critical Thinking Skills of Baccalaureate Nursing Students by Dr. Rene Day (Principal Investigator, and Supervisor to Joanne Profetto-McGrath, PhD Candidate and co-investigator) and support undertaking this research at this site once appropriate ethics review has been obtained.

Sincerely,

Marilynn J. Wood, RN, DrPH
Dean and Professor

Appendix D

Certification of Ethical Acceptability for Research Involving Human Subjects

University of Alberta
Edmonton
Canada T6G 2G3

Faculty of Nursing
3rd Floor Clinical Sciences Building

Certification of Ethical Acceptability for Research Involving Human Subjects

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NAME OF APPLICANT(S): Joanne Profetto-McGrath, PhD Student

TITLE OF PROJECT: "Critical Thinking Dispositions and Critical Thinking Skills of Baccalaureate Nursing Students"

The members of the review committee, having examined the application for the above named project, consider the procedures, as outlined by the applicants, to be acceptable on ethical grounds for research involving human subjects.

12 Feb 97
Date

Beverley O'Brien, DNS
Chair, Ethics Review Committee

ERC 97-114
5005-02-114

Appendix E

Introductory Letter to Students

Joanne Profetto-McGrath
3rd Floor Clinical Sciences Building
Faculty of Nursing, University of Alberta
Edmonton, Alberta
Phone: 492-1597 E-mail: jprofett@ua-nursing.ualberta.ca

February, 1997

Student's Name

Dear _____:

I am a doctoral student in the third year of the PhD in Nursing program at the Faculty of Nursing, University of Alberta. As part of my program I am investigating the critical thinking dispositions and critical thinking skills of baccalaureate nursing students at the Faculty of Nursing, University of Alberta. This information will be useful to you for your own assessment and to the Faculty to further enhance the curriculum. During the month of *March* I will be coming to one of your scheduled nursing classes and invite you to participate in the research that I am undertaking. You will be asked to complete three forms: The Background/Demographic Data Questionnaire, The California Critical Thinking Disposition Inventory (CCTDI), and The California Critical Thinking Skills Test (CCTST).

There will be no cost or harm if you participate in this study . All information collected will be kept confidential. Your name *will not* appear on any of the three forms therefore your name *will not* be associated with any information obtained and used. All the materials related to this research study will be kept in a locked and secure location. Group results of the study will be used for educational purposes and may be shared with others verbally (ex. presentations) or in writing (ex. article). You are free to withdraw from the study at any time by contacting me.

For your own use, I will create an individual profile of your critical thinking dispositions and critical thinking skills. The profiles along with explanatory information will be forwarded to you in a sealed envelope.

My supervisor and I are willing to answer any of your questions now or in the future. As the investigator, I may be contacted at the address, phone number and e-mail at the top of this letter. My supervisor is Dr. Rene Day, Professor at the Faculty of Nursing at the University of Alberta. She can be contacted by phone at 492-6481 or e-mail at rday@ua-nursing.ualberta.ca or the same mailing address as mine.

Thank you for your time and consideration.

Sincerely,

Joanne Profetto-McGrath, R.N., B.Sc.N., M.Ed., PhD Candidate

Appendix F

Script introducing Subjects to the Study

My name is Joanne Profetto-McGrath. I am a graduate student in the PhD in Nursing program at the Faculty of Nursing, University of Alberta. I am here today to invite you to participate in a study that I am conducting to learn about the critical thinking dispositions and critical thinking skills of nursing students in the baccalaureate nursing program. This type of information is helpful to nurse educators and it may also assist you in learning more about yourself. My supervisor is Dr. Rene Day, Professor at the Faculty of Nursing, University of Alberta. *It is very important that you listen and understand the information I will provide you and that you follow the instructions carefully.* Each of you has received a brown envelope containing several documents:

1. Two copies of the consent form (yellow coloured)
2. A background/demographic questionnaire (green sheet)
3. The California Critical Thinking Disposition Inventory (blue booklet)
4. The California Critical Thinking Skills Test - Form A (cream booklet)
5. A white card with a number on it.
6. Two general answer sheets: one for the critical thinking disposition inventory and one for the critical thinking skills test.

It will take you approximately one hour and fifteen minutes to provide the information required and to complete the two booklets; there is little writing involved. If you decide to participate, you will receive a personal profile of your Critical Thinking Disposition and your Critical Thinking Skills.

First, I ask that you locate and read the yellow coloured Consent to Use Data from Background/Demographic Data Questionnaire, California Critical Thinking Disposition Inventory, and California Critical Thinking Skills Test. *Pause*. Are there any questions? If no, I ask that you read the Authorization and sign one copy if you are willing to participate. You are under no obligation to participate and there are no consequences if you choose not to participate. If you do not wish to participate, please leave the envelope and material on your desk. Thank you for considering my proposal. You are free to go.

- If you are willing to participate and have signed both copies of the Authorization, keep one copy and place the signed copy in the envelope. At this time I wish to thank you for participating and giving me your time.
- Now, please print your name on the white index card with the number and place it in the envelope. **Do not write your name** on any other sheet or booklet that follow. Now locate the blue booklet entitled CCTDI, A Disposition Inventory. Using the general answer sheet inserted inside the front cover begin your responses by indicating how much you agree or disagree with each numbered statement by filling out the appropriate place on the answer sheet (1 being agree strongly and 6 being disagree strongly). You have 15 minutes to respond. At the end of 15 minutes I will say "time is up please place the inventory and answer sheet inside the envelope".
- Next, locate the cream booklet entitle the California Critical Thinking Skills Test, CCTST -- Form A. Using the general answer sheet provided inside the front cover record your responses by filling in the circle related to the number of your response. A blank sheet has been provided to allow you to do work in arriving at a response. This is a typical multiple choice test. Select the answer, which in your judgement, is the **BEST** choice of the ones provided. Your score will be computed based on the number of questions you answer correctly. You have 45 minutes to answer the 34 questions that make up the test. There is no talking permitted during the test. If you finish early you should review your answers and then place the booklet in the envelope. Please **do not** complete the optional background questions at the bottom of page 10 of the booklet. *Pause*. Do you have any questions? (Answer any questions posed.) If there are no questions begin the test by stating: "You may begin the test now". When 45 minutes have elapsed, I will ring a bell and proceed to the statement that follows.
- Lastly, complete the green coloured Background/Demographic Questionnaire by responding to the questions directly on the sheet. When you have completed the questionnaire, place it in the envelope. Hand the envelope in as you leave the room quietly.

Appendix G

Consent to Use Data from the Background/Demographic Data Questionnaire, the California Critical Thinking Disposition Inventory, and the California Critical Thinking Skills Test

PROJECT TITLE: Critical Thinking Dispositions and Critical Thinking Cognitive Skills of Baccalaureate Nursing Students.

INVESTIGATOR: Joanne Profetto-McGrath, R.N., B.Sc.N., M.Ed., PhD Candidate
Faculty of Nursing, University of Alberta
3rd Floor, Clinical Sciences Building
Edmonton, Alberta, T6G 2G3
Phone: 492-1597 E-mail: jprofett@ua-nursing.ualberta.ca

You are invited to participate in a research study that the investigator is undertaking as part of her doctoral program at the University of Alberta. The purpose of this study is to investigate the critical thinking dispositions and critical thinking skills of baccalaureate nursing students. Results of this study may help you appreciate your critical thinking abilities and helpful to faculty in enhancing the curriculum. You are being asked to complete three forms: Background/Demographic Data Questionnaire, The California Critical Thinking Disposition Inventory (CCTDI), and The California Critical Thinking Skills Test (CCTST). You should be able to complete the three forms in approximately one hour and fifteen minutes.

There will be no harm to you if you participate in this study. You are free to withdraw from the study at any time by contacting me. Your name does not appear on any of the three forms so your name is not associated with any information obtained and used. All forms, computer discs, and print outs will be kept in a locked and secure location. Group results of the study may be used for educational purposes and may be presented to others verbally or in writing. If your responses are used again for future studies, appropriate approval will be obtained from the appropriate ethical review committee.

For your own use, the investigator will create an individual profile of your critical dispositions and critical thinking skills. This information will be forwarded to you in a sealed envelope. To enable the investigator to do this, you are being asked to print your name on the white card with an identification number corresponding to the CCTDI and CCTST you complete. The card will be destroyed after your profile is sent to you. Your name will not be recorded on any disc or list.

The investigator and her supervisor are willing to answer any of your questions now or in the future. The investigator may be contacted at the address, phone number and e-mail at the top of the page. The supervisor is Dr. Rene Day, Professor at the Faculty of Nursing at the University of Alberta. She may be contacted by phone at 492-6481 or e-mail at rday@ua-nursing.ualberta.ca or the same mailing address as mine. If you are willing to participate in the study please sign the following authorization. You may keep a copy of this form for reference.

Authorization

I have received a copy of the explanation and consent to take part in this study. I have had an opportunity to have my questions answered. I understand what the study is about and what I am being asked to do. I will permit my responses to the CCTDI, CCTST, and Demographic Data Questionnaire to be used for this study.

_____
(Participant's Name - printed)

_____ _____
(Participant's Signature) (Date)

_____ _____
(Investigator's Signature) (Date)

Appendix H
The California Critical Thinking Skills Test

Appendix I
The California Critical Thinking Disposition Inventory

California Academic Press

CCTDI

A Disposition Inventory

Dr. Peter A. Facione
Santa Clara University

Dr. Noreen C. Facione
University of California, San Francisco

Wait for the instruction to begin.

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(PAF47:F3-2:020694)

CCTDI

DIRECTIONS:

1. Carefully separate the last page (ANSWER SHEET) from this test booklet.
2. Put your name on the answer sheet and on the test booklet.
3. Indicate how much you agree or disagree with each numbered statement by filling in the appropriate place on the answer sheet. Read the two examples first.

EXAMPLE A: **The best things in life are free.**

EXAMPLE B: **I'm always doing more than my share of the work.**

The answer sheet shows the responses of someone who
STRONGLY DISAGREES with EXAMPLE A
and LESS STRONGLY AGREES with EXAMPLE B.

Begin with statement number 1 and continue through number 75. Mark your response on the answer sheet in the place with the corresponding number. If you erase a response, be sure the erasure is clean.

4. After you have responded to the 75 statements, fill in the information items printed at the bottom of page 5.

---

1. **Considering all the alternatives is a luxury I can't afford.**

2. **Studying new things all my life would be wonderful.**

3. **The best argument for an idea is how you feel about it at the moment.**

4. **My trouble is that I'm easily distracted.**

5. **It's never easy to decide between competing points of view.**

6. **It bothers me when people rely on weak arguments to defend good ideas.**

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7. The truth always depends on your point of view.

8. It concerns me that I might have biases of which I'm not aware.

9. I always focus the question before I attempt to answer it.

10. I'm proud that I can think with great precision.

11. We can never really learn the truth about most things.

12. If there are four reasons in favor and one against, I'd go with the four.

13. Men and women are equally logical.

14. Advice is worth exactly what you pay for it.

15. Most college courses are uninteresting and not worth taking.

16. Tests that require thinking, not just memorization, are better for me.

17. I can talk about my problems for hours and hours without solving anything.

18. Others admire my intellectual curiosity and inquisitiveness.

19. Even if the evidence is against me, I'll hold firm to my beliefs.

20. You are not entitled to your opinion if you are obviously mistaken.

21. I pretend to be logical, but I'm not.

22. It's easy for me to organize my thoughts.

23. Everyone always argues from their own self interest, including me.

24. Open-mindedness has limits when it comes to right and wrong.

25. It's important to me to keep careful records of my personal finances.

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26. When faced with a big decision, I first seek all the information I can.

27. My peers call on me to make judgments because I decide things fairly.

28. Being open-minded means you don't know what's true and what's not.

29. Banks should make checking accounts a lot easier to understand.

30. It's important to me to understand what other people think about things.

31. I must have grounds for all my beliefs.

32. Reading is something I avoid, if possible.

33. People say I rush into decisions too quickly.

34. Required subjects in college waste time.

35. When I have to deal with something really complex, it's panic time.

36. Foreigners should study our culture instead of us always trying to understand theirs.

37. People think I procrastinate about making decisions.

38. People need reasons if they are going to disagree with another's opinion.

39. Being impartial is impossible when I'm discussing my own opinions.

40. I pride myself on coming up with creative alternatives.

41. Frankly, I am trying to be less judgmental.

42. Frequently I find myself evaluating other people's arguments.

43. I believe what I want to believe.

44. It's just not that important to keep trying to solve difficult problems.

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45. I shouldn't be forced to defend my own opinions.

46. Others look to me to establish reasonable standards to apply to decisions.

47. I look forward to learning challenging things.

48. It makes a lot of sense to study what foreigners think.

49. Being inquisitive is one of my strong points.

50. I look for facts that support my views, not facts that disagree.

51. Complex problems are fun to try to figure out.

52. I take pride in my ability to understand the opinions of others.

53. Analogies are about as useful as a sailboat on a freeway.

54. You could describe me as logical.

55. I really enjoy trying to figure out how things work.

56. Others look to me to keep working on a problem when the going gets tough.

57. Getting a clear idea about the problem at hand is the first priority.

58. My opinion about controversial topics depends a lot on who I talk to last.

59. No matter what the topic, I am eager to know more about it.

60. There is no way to know whether one solution is better than another.

61. The best way to solve problems is to ask someone else for the answers.

62. Many questions are just too frightening to ask.

63. I'm known for approaching complex problems in an orderly way.

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64. **Being open-minded about different world views is less important than people think.**

65. **Learn everything you can, you never know when it could come in handy.**

66. **Life has taught me not to be too logical.**

67. **Things are as they appear to be.**

68. **If I have to work on a problem, I can put other things out of my mind.**

69. **Others look to me to decide when the problem is solved.**

70. **I know what I think, so why should I pretend to ponder my choices.**

71. **Powerful people determine the right answer.**

72. **It's impossible to know what standards to apply to most questions.**

73. **Others are entitled to their opinions, but I don't need to hear them.**

74. **I'm good at developing orderly plans to address complex problems.**

75. **To get people to agree with me I would give any reason that worked.**

Please respond to these final items in the places provided on this page.

Name (last/first) _____ / _____

I.D. __ __ __ __ __ __ __ __ __

Date of Birth (month/day/year) ____/____/____

Circle one: Female, Male

Grade Level: 7th, 8th, 9th, 10th, 11th, 12th, College1, Col2, Col3, Col4, BA/BS, MA/MS, PhD/JD/MD

When I graduate [graduated] from college, I probably will have [did] major in: _____

I am pursuing [expect to pursue] a career as a: _____

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Appendix J

Background/Demographic Questionnaire

(To be filled out after completion of the inventory and test)

I.D. Number _____ **Entry Number** _____

1. Gender

_____ 1. Female
_____ 2. Male

2. Is English your native language?

_____ 1. Yes, it is.
_____ 2. No, I first learned to speak some other language.

3. What was your HIGHEST level of academic achievement before admission to the nursing program? (Check one only)

_____ 1. Less than high school diploma
_____ 2. Some high school courses
_____ 3. High school diploma or equivalent
_____ 4. Some college level courses
_____ 5. Some university level courses
_____ 6. Diploma or certificate Please specify _____
_____ 7. Baccalaureate degree Please specify _____
_____ 8. Other Please specify _____

4. In what year of the program are you currently enrolled? (Check only one)

_____ 1. Year 1
_____ 2. Year 2
_____ 3. Year 3
_____ 4. Year 4

5. If you are currently in Year 3 or 4, are you part of the accelerated program?

_____ 1. Yes
_____ 2. No

6. As a student in nursing, which statement BEST describes your experience with problem-based learning?

_____ 1. I have been involved with problem-based seminars during each term of each year.
_____ 2. I have been enrolled in specific course(s) that have used only problem-based learning.
_____ 3. I have been enrolled in some courses which have utilized a problem-based learning approach.
_____ 4. I have never experienced problem-based learning while I have been in the program.

7. Have you ever completed a college or university level course specifically designed to teach you to think logically, to improve your reasoning, or to sharpen your critical thinking skills?

_____ 1. Yes, I took such a course _____ years ago.
_____ 2. No, I have never taken such a course.

8. Out of the 34 items on the California Critical Thinking Cognitive Skills Test I am confident I answered _____ of them correctly.

9. In terms of deciding what to believe or what to do, critical thinking and being logical are

_____ 1. a waste of time.
_____ 2. helpful, but not nearly as important as lots of other things.
_____ 3. more important than most other things.
_____ 4. extremely important.

10. How old were you (rounded off to the nearest year) on January 1, 1997? I was _____ years old?

California Critical Thinking Skills Test

CCTST -- Form A

Wait for the instruction to begin.

INFERENCE

ANALYSIS

Critical Thinking

EXPLANATION

INTERPRETATION

EVALUATION

SELF-REGULATION

Dr. Peter A. Facione, Santa Clara University

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[PAF4561-11:D03169k]

THE CALIFORNIA CRITICAL THINKING SKILLS TEST

FORM A

DIRECTIONS: Read each question carefully, then select the best choice from among those provided. There are 34 test questions. Each test question is of equal value, so use your time wisely. You may write in this test booklet if you wish.

1. Passage: "Terry, don't worry about it. You'll graduate someday. You're a college student. Right? And all college students graduate sooner or later." Assuming all the support statements are true, the conclusion

A= could not be false.
B= is probably true, but may be false.
C= is probably false, but may be true.
D= could not be true.

2. Passage: "Look at how these pine trees are growing. They are lined up perfectly straight. And they are close to each other, so if any tree falls it will have to knock down the next tree in the line. They're set up like dominoes! So, if I knock the first tree into the second, then the whole line of pines will fall." Assuming its premises are true, the main claim of this passage

A= could not be false.
B= is probably true, but may be false.
C= is probably false, but may be true.
D= could not be true.

3. Passage: "The microorganisms in this pond are of the kind which generally reproduce only in water with a temperature above the freezing point. Now it's winter time and this pond is solid ice. So, if there are any microorganisms of the kind we are researching in the pond, they aren't reproducing right now." Assuming all the supporting statements are true, the conclusion of this passage

A= could not be false.
B= is probably true, but may be false.
C= is probably false, but may be true.
D= could not be true.

4. Consider the claim: "Even Thomas Jefferson used evasive language sometime or other," as this claim relates to the following reason: "After all, every politician has to please a constituency. And Thomas Jefferson, even though he was a great statesman, was also a politician. But nobody can please a constituency without, at least on some occasions, using evasive language." Assuming all the statements made as part of the reason are true, the initial claim

A= could not be false.
B= is probably true, but may be false.
C= is probably false, but may be true.
D= could not be true.

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5. "Not all the candidates are qualified to serve," expresses the same idea as:

A= None of the candidates are qualified to serve.
B= Some candidate is not qualified to serve.
C= Someone qualified to serve is not a candidate.
D= All candidates are not qualified to serve.

6. Suppose "Only those seeking challenge and adventure should join the Army" were true. Which of the following would express the same idea?

A= If you seek challenge and adventure, you should join the Army.
B= If you join the Army, you should seek challenge and adventure.
C= You shouldn't seek challenge and adventure except by joining the Army.
D= You shouldn't join the Army unless you seek challenge and adventure.

7. Suppose a botanist lecturing about garden plants said, "The rose offers many colors." Which would be the best interpretation of this claim?

A= There is a rose which is more than one color.
B= There is a thing that is more than one color and it is a rose.
C= All roses are more than one color.
D= Not every rose is the same color.
E= All of the above are equally acceptable interpretations.

8. "Ezerinians tell lies," means the same thing as:

A= If anyone is Ezerinian, then that person is a liar.
B= If anyone is a liar, then that person is Ezerinian.
C= There is at least one person who is an Ezerinian who lies.
D= People don't lie unless they are Ezerinian.
E= All of the above mean the same thing.

9. Which of the following is roughly equivalent to saying, "It is not true that if Jones managed the store then Webster managed the factory."

A= Jones did not manage the store unless Webster managed the factory.
B= Either Jones managed the store or Webster managed the factory.
C= If Webster didn't manage the factory, Jones didn't manage the store.
D= Jones managed the store, yet Webster did not manage the factory.
E= None of the above is even roughly equivalent.

10. Consider this passage: "(1) Poland was not a monarchy in 1926. (2) Indeed, many European historians regard the First World War as marking the end of viable European monarchies. (3) A generation later, when World War II started, there were no monarchies in Europe or the western hemisphere, except those which were purely ceremonial. (4) However, it would be a mistake to think we have seen the last of ruling monarchs without taking a serious look at the Middle East." The above passage is best described as:

A= An attempt to show that sentence (1) is true.
B= An attempt to show that sentence (2) is true.
C= An attempt to show that sentence (3) is true.
D= An attempt to show that sentence (4) is true.
E= None of the above because no attempt at proof is made.

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For Questions 11 and 12 use this passage:

"(1) To judge the morality of an action we need only look at its consequences in terms of the greatest good for the greatest number. (2) Right actions are the ones that produce predominantly beneficial consequences; wrong actions yield predominantly harmful consequences. (3) One might imagine an unusual situation in which killing one innocent person could actually lead to great benefits for the entire society. For example, (4) suppose there was a woman prisoner whom you knew for certain to be totally innocent. (5) But suppose everyone else thought she was guilty of a long list of brutal and terrible crimes. (6) Suppose executing her would deter thousands of others from committing similar crimes. (7) In that case, the greatest good of the greatest number demands that you execute the innocent prisoner. So, (8) killing an innocent person can be the right thing to do, even if it violates a given person's right to life."

11. Which sentence in the passage above is the main conclusion or claim?

A= (1). B= (2). C= (3). D= (7). E= (8).

12. Sentence (2) in the passage above is best described as

A= an intermediate claim linking (1) to (3).
B= an explanation or clarification of sentence (1).
C= a reason in support of sentence (1).
D= an immoral claim which is logically irrelevant.
E= the main conclusion or claim of the passage.

13. "Many new and very specialized departments have been created recently within the corporation. This proves that the corporation is very interested in more sophisticated approaches to reaching the marketplace." This passage is best described as missing the unstated

A= conclusion, "The corporation will soon do a better job of reaching the marketplace."
B= conclusion, "Management wanted to come up with new approaches to reaching the marketplace."
C= premise, "The corporation was failing to reach the marketplace before these new departments were developed."
D= premise, "These new departments are working on sophisticated, new approaches to reaching the marketplace."
E= conclusion, "Corporations exist primarily, if not exclusively, to serve the interests of their owners."

14. Consider this group of statements: "Nero was emperor of Rome in the first century AD. Every Roman emperor drank wine and did so using exclusively pewter pitchers and goblets. Whoever uses pewter, even once, has lead poisoning. Lead poisoning always manifests itself through insanity." Which of the following must be true if all of the above are true?

A= Those who suffer from insanity used pewter at least once.
B= Whatever else, Emperor Nero was certainly insane.
C= Exclusive use of pewter was a privilege reserved for Roman emperors.
D= Lead poisoning was common among the citizens of the Roman Empire.

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15. Consider these statements true: "Stylish dressers are neither flashy nor dull. If someone is not flashy, then such a person is tasteful." Which of the following must be true, if both of the above are true?

A= Stylish dressers are neither tasteful nor dull.
B= If someone is a stylish dresser, that person is dull but tasteful.
C= Every stylish dresser is tasteful and not dull.
D= No tasteful dressers are dull.
E= None of the above.

16. Consider this group of statements true: "If Alex loves anybody, he loves Barbara. There are many people whom Barbara does not love, and Alex is one of them. But, everybody loves somebody." Which of the following must be true, if all of the above are true?

A= Somebody loves everybody.
B= Barbara loves nobody.
C= Alex loves Barbara.
D= None of the above.

Questions 17 and 18 are based on the following fictional situation: A college has exactly seven student clubs — 1, 2, 3, 4, 5, 6, and 7. The college dean must pick exactly five club members, each from a different club, to serve on an important committee. Any combination of five people will do, except that if someone from 1 is selected, no one from 5 can be selected. Also, if someone from 3 is picked, someone from 5 must be picked. And, if someone from 2 is put on the committee, a member of 6 must also be put on the committee.

17. Here are five possible combinations of people for the committee. Which is the only combination that meets all the conditions?

A= 1, 2, 4, 5, 6
B= 2, 3, 4, 5, 6
C= 2, 3, 4, 6, 7
D= 1, 4, 5, 6, 7
E= 1, 2, 3, 6, 7

18. Assume the dean decides not to select someone from club 7. In that case, which other club cannot be represented on the committee?

A= 5. B= 4. C= 3. D= 2. E= 1.

19. Consider the "krendalog" relationship. It is defined as follows: "Only humans are krendalogs. But not every member of the human species has krendalogs. Nobody can be a krendalog to themself, but today every human is someone's krendalog. If someone is your krendalog, then all that person's krendalogs are your krendalogs too. If someone is your krendalog, then you cannot be that person's krendalog. Assume the first two humans, the long ago deceased ancestors of our species, were named Jake and Kathy." Given this meaning of "krendalog" we can say for sure that

A= Jake and Kathy are krendalogs to one another.
B= Jake or Kathy is each their own krendalog.
C= Someone is neither Jake's nor Kathy's krendalog.
D= All of us are krendalogs to Jake and Kathy.
E= None of the above because this concept does not make sense.

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For Questions 20, and 21 use this fictitious case: "In a study of high school students at Mumford High, it was found that 75% of those students who drank two or more beers each day for a period of 60 days experienced measurable liver function deterioration. That these results could have occurred by chance was ruled out experimentally with high levels of confidence."

20. If true, the Mumford High information would confirm that

A= Drinking is statistically correlated with liver deterioration in adolescents.
B= Drinking causes liver deterioration in adolescents.
C= Sex is not a factor in the relationship between alcohol and liver deterioration.
D= The researcher had a personal reason to want to prove young people should not drink.
E= The drinking age laws are out of date and should be changed.

21. If the information in the Mumford High case were true, which of the following hypotheses would <u>not</u> have to be ruled out in order to confirm the claim that for about 75 adolescents out of 100, after two months of drinking as little as two beers a day, measurable liver deterioration can be found?

A= Liver deterioration occurs only in inexperienced beer drinkers, but it levels off after people have been drinking beer for longer periods of time.
B= Since teens brag about their drinking, the positive relationship between drinking and adolescent liver function deterioration is much higher than reported.
C= Since the students at Mumford High are predominantly Black or Hispanic, the findings do not apply to adolescents in general.
D= Liver function deterioration in adolescents is the result of other factors, such as normal growth and development, poor diet, and sports injuries.
E= Since school officials failed to keep this research project confidential, the purpose of this study was known by the students being tested and by unauthorized persons.

22. Assume that whenever it is snowing, streets and sidewalks are wet and slippery. Given that assumption, which of the following <u>must</u> also be true?

A= If the sidewalks and streets are slippery or wet, then it is snowing.
B= If it is not snowing, the streets and sidewalks are not slippery.
C= If the sidewalks are wet or the streets are slippery, it is snowing.
D= If the sidewalks are slippery but the streets dry, it is not snowing.
E= It is snowing, the sidewalks are wet and the streets are slippery.

23. Consider this argument: "Person L is shorter than person X. Person Y is shorter than person L, but person M is shorter than person Y. Therefore, person Y is shorter than person J." What information <u>must</u> be added to require that the conclusion be true, assuming all the premises are true?

A= Person L is taller than J.
B= Person X is taller than J.
C= Person J is taller than L.
D= Person J is taller than M.

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For Questions 24 and 25 use this fictional passage:

"Research at the Happy-Days Pre-School on the campus of State University showed that four-year-old children who attended the Happy-Days Pre-School all day for 9 months averaged 58 points on a standardized test of kindergarten readiness. The research showed also that those four-year-olds who attended only in the morning for 9 months averaged 52, and those four-year-olds who attended afternoons only for 9 months averaged 51. A second study of four-year-olds who attended Holy Church Pre-School all day for 9 months showed these children averaged 54 on the same kindergarten readiness test. A third study of four-year-olds who attended no pre-school and were all from low income households showed an average score of 32 on the same test. The difference between 32 and the other scores was found to be statistically significant at the .05 level of confidence."

24. Initially, the most plausible scientific hypothesis regarding the data is

A= a child who scores 50 or higher is ready for kindergarten.
B= more testing is needed before a plausible hypothesis can be formed.
C= pre-school attendance is not related to kindergarten readiness.
D= there should be funding for four-year-olds to attend pre-school.
E= attending a pre-school is correlated with kindergarten readiness.

25. To scientifically disconfirm choice C in question 24 above, one would have to

A= find that 95% of all four-year-olds were kindergarten-ready.
B= find a child who is kindergarten-ready but did not attend pre-school.
C= find that there is less than 5% chance that the relationship occurs randomly.
D= do nothing. There is no way to scientifically disconfirm it.

26. "There seem to be two popular arguments in favor of life after death. One is that each of us has an immortal soul which does not die just because our body dies. The other is that some kind of belief in life after death is found in the religious traditions of almost all cultures. But clearly, the second reason does not prove the belief is true. The fact that millions of people believe in it does not make it so! So, there is no such thing as life after death." The speaker's reasoning is best evaluated as

A= good. It shows there probably is no life after death.
B= good. But it is factually mistaken about life after death.
C= poor. It did not consider the argument about souls not dying.
D= poor. It did not show the relevance of cultural differences.

27. "The cost of jet fuel has risen dramatically since the 1989 Exxon oil tanker disaster in Alaska and the 1991 war in the Middle East. In that same time the costs of several petroleum derivatives have also gone up sharply. These two facts establish that jet fuel is a petroleum derivative." The best evaluation of the speaker's reasoning is

A= good thinking, because jet fuel is a petroleum derivative.
B= good thinking, but not all the facts are stated accurately.
C= bad thinking. The cost of food has gone up in the same time, but that does not prove that jet fuel is food.
D= bad thinking. One can draw no conclusions about jet fuel, given facts about petroleum derivatives.

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28. "In the half-light of predawn, little Christopher J. sat quietly with his nose pressed against the cool glass of his bedroom window. He wanted very much for it to be morning so he could go outside and play baseball. Concentrating very hard, he wished and wished for the sun to appear. And as he wished, the sky began to brighten. He kept wishing. And, sure enough, the sun moved right up over the horizon and into the morning sky. He was proud of himself. Christopher thought about what had happened and decided he could make any cold and lonely night turn into a bright and happy summer day, if he wanted." The best evaluation of Christopher's reasoning is

A= poor. That it happened after he wished it doesn't mean it happened because he wished it.
B= poor. The sun goes around the earth with or without his wishing it.
C= good. Christopher is only a child.
D= good. What evidence does he have that if he had not wished it, it would not have happened?

29. "Confidentiality is an important part of the relationship between doctor and patient. But protecting innocent people from serious harm is also important. Nobody can say with certainty which value is the more important of the two. This can create some agonizing dilemmas. For example, a doctor may know that a patient is going to harm someone or be harmed by someone, as in the case of suspected child abuse. This puts the doctor in a difficult situation regarding whether to maintain confidentiality or to inform the proper authorities about the suspected danger." The best evaluation of the speaker's reasoning is

A= good thinking, because confidentiality cannot be compromised.
B= good thinking, because in the abstract these values conflict.
C= poor thinking, because in practice doctors do choose one value over another.
D= poor thinking, because the law clearly says protecting the child is more important.

30. "A standard deck of 52 playing cards contains exactly four kings, four queens, and four jacks. For our purposes we will say that these twelve cards are the only `face-cards' in the standard deck. The other cards are numbered ace through ten. For the sake of simplicity we can call these other cards the `numbered-cards.' Now, suppose you are handed a well- shuffled standard deck of 52 cards. So, from what we know now, we can conclude that among the 52 playing cards in a standard deck there are precisely four each of jacks, queens, and kings." The author's way of demonstrating this conclusion is best evaluated as

A= poor. It proves nothing, as in "The sky is blue because it's blue."
B= good. The conclusion is an accurate restatement of the given facts.
C= good. The reasoning fully considers each card in the standard deck.
D= poor. It fails to consider the odds of drawing a face-card.

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For Questions 31, 32, 33 and 34 focus on the faulty inference in the following fictional case:

A speech writer working for a white supremacist group claimed that white Americans were "genetically superior to Blacks, Hispanics, Asians, Iranians and all the other mongrel races in terms of native human intelligence." To support this claim, the speech writer quoted a study which compared two groups of tenth graders. Each group was given the same exam covering European geography. The exam focused on European rivers, mountain ranges, countries, capital cities, agriculture, industry, religion, music and languages. Group A was 35 tenth graders, 34 of whom were whites with Anglo-European family names. Group A students attended a private college prep school in wealthy Orange County, California. That school requires ninth graders to take a year of European history. Group B was 40 tenth graders, all but 4 of whom were Hispanic, Black, Asian or Middle Eastern. Group B students attended a public high school in a violent, gang infested ghetto commu nity of south central Los Angeles County. Ninth graders at the public high school take a year of world history. The writer pointed out that Group A did significantly better on the geography test than Group B.

31. Suppose a political scientist objected, saying, "The inference from these data to the claim being made is faulty because this researcher overlooks the guarantees in the US Constitution regarding equal educational opportunity." If true, is this political scientist's reason good or not, and why?

A= Bad reason. These rights were respected in the original research.
B= Bad reason. These rights are irrelevant to this research.
C= Good reason. A violation of key rights makes a study unacceptable.
D= Good reason. Equal educational opportunity is a vague concept.

32. Suppose a developmental psychologist argues, "The inference from these data to the claim being made is faulty because the study does not take into account the impact of environment on intelligence." If true, would this psychologist's reason be a good or a bad reason, and why?

A= Good reason. This factor must be taken into account.
B= Good reason. Environment, not genetics is the major factor in determining intelligence.
C= Bad reason. Nobody had proven that environment can affect learning geography.
D= Bad reason. It is very difficult to measure the effects of environment on intelligence.

33. Suppose a female social worker objected, "You can't expect Group B children to be as intelligent. After all, they come from a background of poverty, crime and broken families." If true, would this social worker's reason be a good or bad reason, and why?

A= Good reason. Poor neighborhoods mean poor schools, poor schools mean poor teachers, poor teachers mean poor students, poor students mean poor test scores.
B= Good reason. Regardless of race, children from these kinds of backgrounds are less intelligent than children from wealthy backgrounds.
C= Bad reason. Regardless of socioeconomic conditions, intelligence depends on the quality of the school you attend.
D= Bad reason. Poverty, wealth and family circumstances do not make a person more or less intelligent.

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34. Suppose a militant African-American student teacher angrily objected, "What do you expect! The rich kids took a course in European history, but the poor kids didn't. Sure, they're going to know more about Europe." If true, would this student teacher's reason be a good reason or a bad reason, and why?

A= Good reason. Knowledge of facts does not measure intelligence.
B= Bad reason. She is only a student teacher and probably does not have the research or teaching experience to support her claims.
C= Bad reason. She's obviously responding defensively because she is Black and feels insulted by the conclusions the speech writer drew.
D= Good reason. The differences in what they were taught in the ninth grade would tend to give Group A an advantage over Group B on that geography exam.

THAT WAS THE LAST QUESTION

If time permits, you may go back and check your answers.

OPTIONAL BACKGROUND QUESTIONS

1. Out of the 34 items on this test I am confident I answered _____ of them correctly.

2. English is my native language.
   A. Yes, it is.
   B. No, I first learned to speak some other language.

3. Check one: I am _____ male _____ female.

4. When I graduate [graduated] from college, I probably will have [did] majored in _____.

5. Have you ever completed a college course specifically designed to teach you to think logically, to improve your reasoning, or to sharpen your critical thinking skills?
   A. Yes, I took such a course _____ years ago.
   B. No.

6. I expect to pursue a career as a _____.

7. In terms of deciding what to believe or what to do, critical thinking and being logical are
   A. a waste of time.
   B. helpful, but not nearly as important as lots of other things.
   C. more important than most other things.
   D. extremely important.

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